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CONSTRUCTION OF BRIDGES IN THE FIELD TO TAKE HEAVY MOTOR TRANSPORT.

By CAPT. G. C. GOWLLAND, R.E.

ALL semi-permanent bridges built in war must be capable of carrying the heaviest form of motor lorry. Field engineers must therefore be prepared to span gaps up to 100 ft. with bridges that are able to carry a train of heavy lorries.

The material available will be planks, round and flat steel or iron bars, bolts, spikes, nails, etc. The type of design must depend on the material at hand. In the present case no attempt is made to put forward a type design. An ordinary gap is taken and three methods of bridging it are suggested.

A gap of 40 ft. is to be bridged. The loading to be a train of heavy motor lorries. The wheel track is 6 ft. 8½ in. Distance between wheel girders 8 ft. 6 in. Load on hind axle 17,700 lbs. Load on fore axle 7,100 lbs. When lorries are crowded it is assumed that there will be a distance of 10 ft. between the fore axle of one lorry and the hind axle of the one in front. It is assumed that the timber at hand takes 1,200 lbs. per square inch in tension or compression and that the steel will take 7·5 tons per square inch in tension.

To find the maximum bending moment under a train of lorries :—

In a 40-ft. span only two lorries can be on the bridge at once. It is obvious that the M_{ff} will occur when there are two lorries on the bridge and when the hind axle of one of them is near the centre, *i.e.* when the loads are in some such position as *Fig.* 1 in which case the M_{ff} will be under the load A.

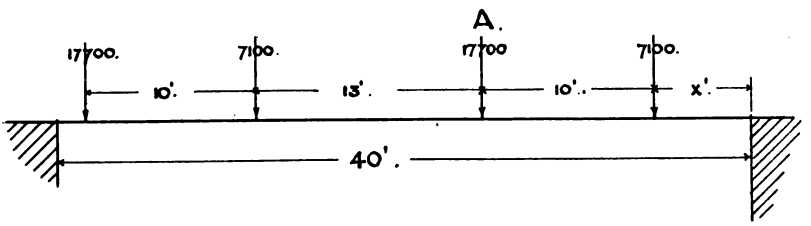

FIG. 1.

To find the actual position of the loads giving the maximum bending moment, find the centre of gravity of all the loads on the bridge and then arrange them so that the centre of the beam bisects the distance between the position of the centre of gravity and the load under which the M_{ff} occurs.

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To find the C.G. of the loads.

Let the C.G. be distant x feet from the left-hand load.

Then $$49600 \times x = 7100 \times 10 + 17700 \times 23 + 7100 \times 33.$$

$$\therefore \quad x = 14{\cdot}4 \text{ about.}$$

The M_{ff} will therefore occur when the loads are as in *Fig.* 2 and will be under the load A.

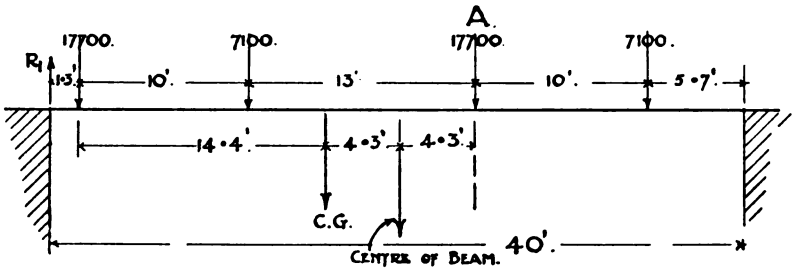

FIG. 2.

Find R_1 in *Fig.* 2.

$$R_1 \times 40 = 7100 \times 34{\cdot}4 + 17700 \times 54{\cdot}4.$$

Whence $$R_1 = 30{,}178 \text{ lbs.}$$

$$\therefore \quad M_{ff} = 30178 \times 24{\cdot}3 - 7100 \times 13 - 17700 \times 23.$$

Whence $$M_{ff} = 233{,}925 \text{ foot-lbs.}$$

If we consider the sum of all the weights on the bridge as being evenly distributed we have

$$M_{ff} = \frac{WL}{8} = \frac{49600 \times 40}{8} = 248{,}000 \text{ foot-lbs.}$$

This as a rough approximation is good enough as a rule in cases of ordinary loading. The actual maximum bending moment is 233,925 foot-lbs. This is caused by a live load and to reduce to equivalent dead load multiply by 2. This gives M_{ff} of 467,850 foot-lbs. over the whole bridge due to equivalent dead load.

Case I.—Suppose we have plenty of round steel bars, planking and means of cutting screw threads. Probably the best form of bridge will be an N girder using round steel rods as ties and carrying the roadway on the top boom. Before we can work out the stresses in the girder we must decide how the load is distributed over it.

DISTRIBUTION OF LOADING.

The M_{ff} is 467,850 foot-lbs.

Let W lbs. be an evenly distributed load that produces an M_{ff} in the girder of 467,850 foot-lbs.

Then $$\frac{W \times 40}{8} = 467850.$$

$$\therefore \quad W = 93{,}570 \text{ lbs.}$$

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Therefore if we load the bridge with an evenly distributed load of 2,339 lbs. per foot-run we obtain a bending moment equal to that produced when the lorries are producing their maximum bending moment on the bridge.

The span of the bridge is 40 ft. We can conveniently use panels 5 ft. × 5 ft., in which case each panel point takes 11,695 lbs. If we use two girders we see that each panel point has to take $\frac{11695}{2}$ lbs., say 6,000 lbs. In addition to this each panel point has a load due to the dead weight of the bridge.

The dead weight of each girder is say $1\frac{1}{2}$ tons.

Therefore the load per panel point due to dead load is 420 lbs.

The loading for each girder will therefore be as in *Fig.* 3 if two girders are used.

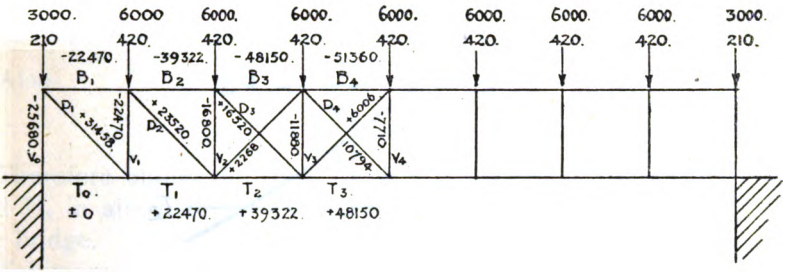

FIG. 3.—*Stresses if two girders are used.*

Having obtained the loading of the girder obtain the stresses by method of sections, forces acting upwards being considered negative.

The stress in V_0 is maximum under full load and equals the reaction.

$$\therefore \qquad V_0 = -25{,}680 \text{ lbs. compression.}$$

The stress in $T_0 = 0$.

To find $B_1V_1T_1D_1$. Take a section as in *Fig.* A. The sum of the vertical forces is zero.

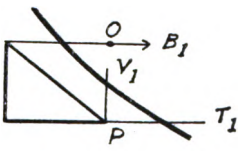

FIG. A.

$$\therefore \qquad +V_1 + (6000 + 420)\left(\tfrac{1}{8} + \tfrac{2}{8} + \tfrac{3}{8} + \tfrac{4}{8} + \tfrac{5}{8} + \tfrac{6}{8} + \tfrac{7}{8}\right) = 0.$$

$$\therefore \qquad V_1 = -22{,}470 \text{ lbs. compression.}$$

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Taking moments about P.

$$-B_1 \times 5 - (6000 + 420)\left(\tfrac{1}{8} + \tfrac{2}{8} \ldots \tfrac{7}{8}\right) \times 5 = 0.$$

$$\therefore \qquad B_1 = -22{,}470 \text{ lbs. compression.}$$

Taking moments about O. T_1 is found equal to B_1 but of different sign.

$$\therefore \qquad T_1 = +22{,}478 \text{ lbs. tension.}$$

Also $$-D_1 \sin 45 = V_1.$$

$$\therefore \qquad D_1 = +31458 \text{ tension.}$$

To find $V_2B_2T_2D_2$. Take a section as in *Fig.* B.

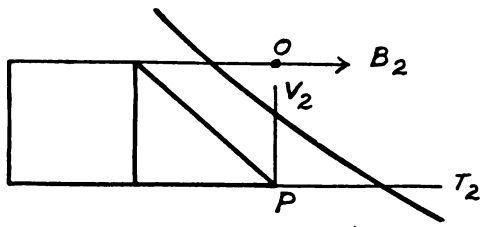

FIG. B.

$$+V_2 + 420\left(\tfrac{1}{8} + \tfrac{2}{8} + \tfrac{3}{8} + \tfrac{4}{8} + \tfrac{5}{8} + \tfrac{6}{8} - \left(1 - \tfrac{7}{8}\right)\right) + 6000\left(\tfrac{1}{8} + \tfrac{2}{8} \ldots \tfrac{6}{8}\right) - 6000\left(1 - \tfrac{7}{8}\right) = 0.$$

$$\therefore \qquad V_2 + 1050 + 15750 - 750 = 0.$$

From this equation first omit the negative quantity -750 due to the moving load and $V_2 = -16800$. Next omit the positive quantity 15750 due to the moving load and $V_2 = -300$.

Therefore the stresses in V_2 range from $-16{,}800$ lbs. to -300 lbs. that is V_2 is always in compression under any position of loading.

$$-D_2 \sin 45 = V_2.$$

Therefore D_2 varies from 23,520 lbs. tension to 420 lbs. tension.

Taking moments about P.

$$-B_2 \times 5 - (6000 + 420)\left\{\left(\tfrac{1}{8} + \tfrac{2}{8} + \tfrac{3}{8} \ldots \tfrac{6}{8}\right) \times 10 + \tfrac{7}{8}(10 - 5)\right\} = 0.$$

$$\therefore \qquad B_2 = -39{,}322 \text{ lbs. compression.}$$

Taking moments about O. T_2 is found equal to B_2 but of opposite sign.

$$\therefore \qquad T_2 = +39{,}322 \text{ lbs. tension.}$$

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To find $B_3D_3V_3T_3$. Take a section as in *Fig.* C.

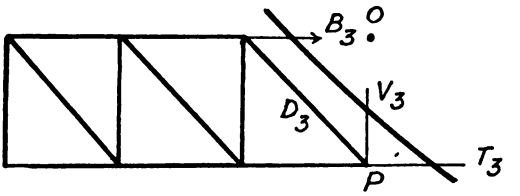

FIG. C.

$$+V_3+420\left(\tfrac{1}{8}+\tfrac{2}{8}+\tfrac{3}{8}+\tfrac{4}{8}+\tfrac{5}{8}-(1-\tfrac{6}{8})-(1-\tfrac{7}{8})\right)+6000\left(\tfrac{1}{8}+\tfrac{2}{8}+\tfrac{3}{8}\ldots\tfrac{5}{8}\right)$$
$$-6000\left(1-\tfrac{6}{8}+1-\tfrac{7}{8}\right)=0.$$

$$\therefore \qquad -V_3=630+11250-2250.$$

Omitting first the negative and then the positive figure from this equation we have $V_3=-11{,}880$ lbs. or $+1{,}620$ lbs.

Also $$-D_3 \sin 45=V_3.$$

$$\therefore \qquad D_3=+16520 \text{ or } -2268.$$

Therefore unless the third panel is cross-braced we shall have V_3 and D_3 in alternate compression and tension as the loads roll over the bridge.

Taking moments about P.

$$-B_3\times 5-6000+420\left\{\left(\tfrac{1}{8}+\tfrac{2}{8}+\tfrac{3}{8}+\tfrac{4}{8}+\tfrac{5}{8}\right)15+\left(\tfrac{7}{8}\times 15-10\right)\right.$$
$$\left.+\left(\tfrac{6}{8}\times 15-5\right)\right\}=0.$$

$$\therefore \qquad B_3=-48150.$$

Also by moments about O.

$$T_3=+48150.$$

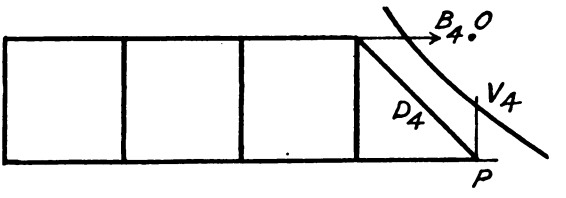

FIG. D.

To find $B_4V_4D_4$. Take a section as in *Fig.* D. Then

$$+V_4+420\left(\tfrac{1}{8}+\tfrac{2}{8}+\tfrac{3}{8}+\tfrac{4}{8}-(1-\tfrac{5}{8})-(1-\tfrac{6}{8})-(1-\tfrac{7}{8})\right)$$
$$+6000\left(\tfrac{1}{8}+\tfrac{2}{8}+\tfrac{3}{8}+\tfrac{4}{8}\right)-6000\left(\left(1-\tfrac{5}{8}\right)+\left(1-\tfrac{6}{8}\right)+\left(1-\tfrac{7}{8}\right)\right)=0.$$

$$\therefore \qquad V_4+210+7500-4500=0.$$

$$\therefore \qquad V_4=-7710 \text{ compression or } +4290 \text{ tension.}$$

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Also $$-D_4 \sin 45 = V_5.$$

$$\therefore \quad D_4 = +10794 \text{ or } -6006.$$

Therefore the centre panel must be cross-braced.

Taking moments about P.

$$-B_4 \times 5 - (6000 + 420)\left\{\left(\tfrac{1}{8} + \tfrac{2}{8} + \tfrac{3}{8} + \tfrac{4}{8}\right) \times 20 + \left(\tfrac{5}{8}\,20 - 5\right) + \left(\tfrac{6}{8}\,20 - 10\right) + \left(\tfrac{7}{8}\,20 - 15\right)\right\} = 0.$$

$$\therefore \quad B_4 = -51360.$$

Therefore stresses may now be written down as in *Fig.* 3.

On examining the stresses in *Fig.* 3 we see that there is a tension of between 14 and 15 tons in one diagonal. The joints will become simpler if four girders are used. *Fig.* 4 gives the stresses in a girder if four girders are used. These stresses are half those in *Fig.* 3.

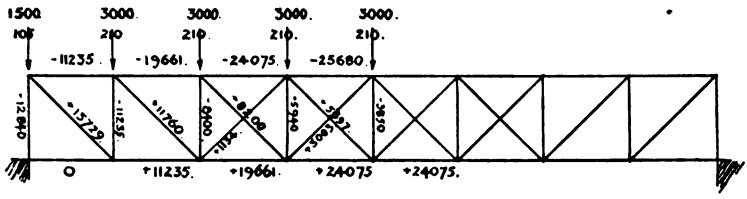

FIG. 4.—*Stresses if four girders are used over 40-ft. span.*

CALCULATION OF MEMBERS OF GIRDER.

Booms.—The greatest stress is 25,680 lbs.

Assuming that we have fir planks the working stress of the timber may be taken as 1,200 lbs. per square inch in tension or compression.

Therefore the number of square inches required in the boom is $\frac{25680}{1200} = 22$ about.

Therefore one 9 in. × 3 in. with a 9-in. × 3-in. cover plate would do. For convenience in construction three 9 in. × 3 in. are used. This gives a working section of 54 square inches.

Jointing of Booms.—Either nails, spikes or bolts may be available.

One 9 in. × 3 in. takes 27 × 1,200 lbs. = 32,400 lbs. in tension or compression.

(i.). Bolts. Suppose $\frac{3}{4}$-in. bolts are available.

Each $\frac{3}{4}$-in. bolt passing through a 9-in. × 3-in. plank can safely take $\frac{3}{4}'' \times 3 \times 1{,}200$ lbs. = 2,700 lbs.

Therefore the number of bolts required on each side of every joint is $\frac{32400}{2700} = 12$ bolts.

(ii.). Nails. Suppose 6-in. nails available.

Each 6-in. nail takes 200 lbs. laterally.

Therefore number of nails required on each side of the joint is $\frac{32400}{200} = 162$ nails.

(iii.). Spikes. Suppose 7-in. spikes available.

Each spike takes 700 lbs. laterally.

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Therefore number of spikes required on each side of a joint is $\frac{32400}{700}=46$.

The joints in the boom are arranged as in *Fig.* 8.

NOTE.—When bolts are nutted up tight the friction between the members will strengthen the joint but friction should not be depended on as the wood will expand and contract under different climatic conditions.

A good substitute for bolts is round steel bars cut to length. A hole of slightly smaller diameter is bored through the booms and the round bars hammered in. If this method is used for jointing booms the compression members should be bound with hoop iron or wire to prevent them opening out when the stress comes on them.

Tension Bars.—$1\frac{3}{8}$-in. round bar of steel with Whitworth thread has effective area of 1 square inch; $1\frac{1}{4}$-in., ·8 square inch; 1-in., ·54 square inch.

Therefore using round steel bars a $1\frac{3}{8}$-in. bar takes in tension when screw threaded 16,800 lbs.; $1\frac{1}{4}$-in., 13,440 lbs.; 1-in., 8,072 lbs.

The bars are therefore arranged as in diagram of completed girder (*Fig.* 7).

Verticals.—The greatest stress is 12,840 lbs. Length of strut is 51 in.

Using a 9 in. × 3 in. strut $\frac{l}{d}=\frac{51}{3}=17$.

Safe compression is 600 lbs. per square inch.

Therefore one 9 in. × 3 in. takes 16,200 lbs.

Or the strut can be looked out in curve for compression members, *M.M.E.*, Part IIIA.

Joints.—The verticals will be held by cleats to the top and bottom boom and nailed through the cleats.

The diagonals will pass through the boom and then nutted up so as to bear on oak cleats on the top and bottom of the two booms. It will be quite safe to bore holes through the boom to take the diagonal ties as the available section is 54 square inches and only 22 square inches is required to take the maximum stress.

The cleats are held to the booms by screws $\frac{3}{4}$-in. diameter (see *Figs.* 9 and 9A).

The resolved part of the greatest diagonal is horizontally about 12,000 lbs.

One $\frac{3}{4}$-in. screw takes 2,100 lbs. laterally. Therefore six screws must be used.

Bearing on Cleats.—The stress in the tie-rod will be distributed over the face of the oak cleat by a $\frac{1}{2}$-in. steel plate.

Oak will take in bearing 1,600 lbs. The tension in the rod is 15,729 lbs. Therefore the number of square inches required is about 10. The number of square inches provided is 27.

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Shear along the Cleat.—Oak in shear along the grain has a safe resistance of 450 lbs. per square inch. Therefore the number of square inches required is $\frac{12000}{450}=27$.

The number of square inches given is 36.

Therefore the joint is sound in all respects.

The girder is therefore put together as shown in *Fig.* 7, etc.

Four such girders will be used, two under each wheel.

Case II.—Supposing no round steel bars available but that flat steel bars are at hand.

The difficulty of making suitable joints with steel bars of small section is at once apparent as accurate drilling cannot be relied on in the field.

To make strong joints bolts will have to pass through various members of steel and wood and if the tie-bar has to take a big stress it will have to be made up of several bars.

With a tie-bar made up of several different members there is a danger of each member being unfairly loaded, unless all drilling of bolt holes is absolutely accurate.

Again, if holes are not accurately drilled, there is a danger that men in a hurry will enlarge holes so that bolts may pass through easily and by so doing the available working sections of members are reduced.

Therefore if flat bar steel is used it is sometimes useful to design a girder when the tension members are not so highly stressed up.

A simple form of girder which accomplishes this can be evolved from the girder already designed.

If the loads on the girder in *Fig.* 4 were only half what they are assumed to be the stresses in the girder would be exactly half those in *Fig.* 4 and eight such girders would be required to safely span the gap. That is eight such girders as are shown in *Fig.* 5 would be required.

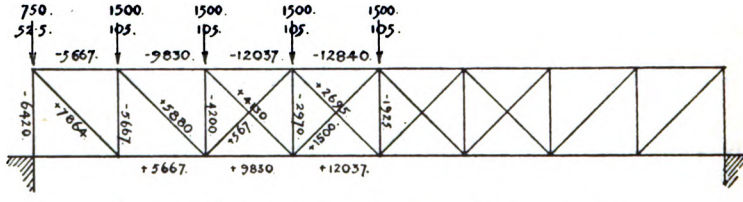

FIG. 5.—*Halved stresses in girder shown in Fig. 4.*

If two such girders with halved stresses are placed so that one overlaps the other by half a panel and if the stresses in the parts of the boom where they overlap are added a girder stressed as in *Fig.* 6

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is obtained, the girder in *Fig.* 6 being able to take the same load as the girder in *Fig.* 4 but it will be noticed that all the stresses in the ties are halved.

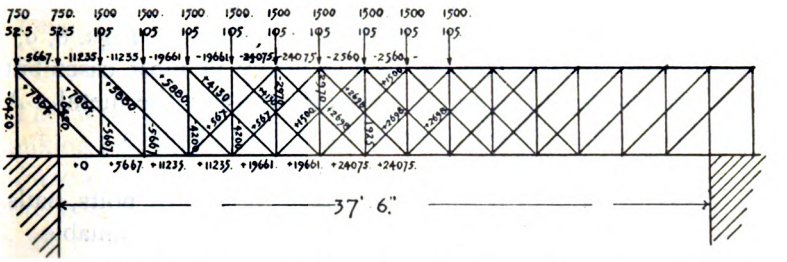

FIG. 6.—*Four such girders to be used. They are made by combining two girders with stresses as in Fig. 5.*

The objection to this girder is that it must be supported as shown and by so doing $2\frac{1}{2}$ ft. is taken from the span.

CALCULATION FOR MEMBERS OF GIRDER IN *Fig.* 6.

Booms.—Maximum stress is the same as in the previous case.

Therefore one 9 in. × 3 in. with one 9-in. × 3-in. cover plate will be sufficient for top and bottom booms.

The number of nails, bolts or spikes on each side of every joint will be the same as in the previous case.

Struts.—The maximum stress in a strut is 6,420 lbs., length of strut is 51 in. Using 6-in. × 3-in. fir

$$\frac{l}{d} = \frac{51}{3} = 17.$$

Therefore from Tables safe stress per square inch is 450 lbs.

Therefore one 6 in. × 3 in. takes 8,100 lbs.

Or the safe stress in a 6-in. × 3-in. strut may be found from curves in *M.M.E.*, iiiA.

Therefore 6 in. × 3 in. will be used for all struts.

For the struts on the abutment use two 6 in. × 3 in. nailed together and nails clinched.

Tie-Bars.—Suppose 2-in. × $\frac{1}{4}$-in. steel bars are available.

These bars will be fixed to the booms by bolts or screws $\frac{3}{4}$-in. diameter.

Each 2-in. × $\frac{1}{4}$-in. bar when bored for a $\frac{3}{4}$-in. bolt takes safely 5,025 lbs. tension.

We see therefore that by using two 2-in. × $\frac{1}{4}$-in. steel bars for each diagonal we shall be more than safe.

Fixing Bars to Booms.—$\frac{3}{4}$-in. diameter screws $4\frac{1}{2}$ in. long will take a lateral pull of 2,100 lbs.

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$\frac{3}{4}$-in. diameter bolt passing through a 9-in. × 6-in. timber takes 5,400 lbs.

The simplest method of fastening the bars to the booms will be with $\frac{3}{4}$-in. screws. Two of these will be wanted for each of the end four diagonals and one for all the centre diagonals.

The completed girder with joint details is shown in *Figs.* 8, 9, 10. It will be seen that the bracing is too heavy in most cases but if narrower bars are used the $\frac{3}{4}$-in. screws take most of the metal. Any lighter form of bracing could be used in the centre panels.

Case III.—If no steel is available except in form of bolts, nails or spikes, it is assumed that plenty of timber planks are obtainable.

In this case a plank girder would be used.

The M_{ff} on the bridge is 467,850 foot-lbs. due to the equivalent dead load.

The M_{ff} due to the dead load of the bridge is 28,600 lbs.

Therefore the total bending moment is 496,450 foot-lbs.

Using four girders each one will have to withstand an M_f of 124,112 foot-lbs.

Using the formula

$$M_{ff} = RAd$$

where

R is safe working stress of timber in lbs. per square inch,
A is effective area of one boom in square inches,
d is the working depth of girder in inches,
M_{ff} is maximum bending moment in inch-lbs.,

d should not be less than $\frac{l}{14} = 33$ in., say 30 in., as this will not give us a weak web.

Then $$124112 \times 12 = 1200 \times A \times 30.$$

$\therefore$ $$A = 42 \text{ square inches about.}$$

Booms.—The working area of either boom must be 42 in. Two 9-in. × 3-in. planks bored for $\frac{3}{4}$-in. bolts give a working area of 49·5 square inches.

Therefore the booms will be made up of three 9 in. × 3 in.

The fastenings in the booms will be the same as in the previous cases.

Web.—The maximum reaction due to the equivalent dead load is 61,200 lbs.

The maximum reaction due to dead load of bridge is 3,360 lbs.

Therefore the total maximum reaction is 64,560.

Therefore the maximum shear in any one of the four girders is 16,140 lbs.

The web will be of planks crossed, nailed and clinched (see *Fig.* 11).

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The resistance of fir to shear with the grain is 150 lbs. and against the grain is 450 lbs. We can therefore assume that one web will take 300 lbs. safely in shear.

Let t inches be thickness of web.

Then $t \times 30 \times 300 = 16140$.

Whence $t = 1{\cdot}8$ in. say 2 in.

The web will therefore be made up of four thicknesses of $\frac{1}{2}$-in. planking two planks on each side of the booms.

Fastening of Web to Booms.—In a vertical length of web of 30 in. there is a shear of 16,140 lbs. Therefore in a horizontal distance of 30 in. there is the same shear of 16,140 lbs., using $\frac{3}{4}$-in. bolts to fix the 2-in. web to the booms. Each $\frac{3}{4}$-in. bolt in bearing takes $\frac{3}{4} \times 2 \times 1{,}200$ lbs. $= 1{,}800$ lbs.

Therefore the number of bolts in a 30-in. length of web is $\frac{16140}{1800} = 9$. Thus bolts will be spaced 3 in. apart near the abutments gradually spacing out towards the centre when the shear gets smaller.

The question of bolts tearing out of the ends of the web must be considered.

The bearing strength of a bolt is 1,800 lbs.

Let l inches be the distance of the bolt hole from the edge of the web (see *Fig.* 11).

The resistance of the timber to shear along the grain is 150 lbs. per square inch.

Therefore l is given by the equation

$$l \times 2 \times 150 \times 2 = 1800.$$

$$\therefore \quad l = 3 \text{ in.}$$

Web Stiffeners.—The maximum reaction is 16,140 lbs. Use 9 in. × 3 in. struts.

The length of the strut is 21 in. so $\frac{l}{d} = 7$.

Therefore safe stress in 9-in. × 3-in. strut is 27,000 lbs.

Space struts at $\frac{2}{3}$ of 30 in. is at 20 in.

Blocks of 4 in. × 4 in. × 9 in. to be placed as in *Fig.* 11.

Struts can be nailed to chocks or boom or be held by hoop iron.

An additional strut is placed as shear in *Fig.* 11 over the abutment.

In a recent article on a bridge erected at the front where the load was taken on the top boom there was a note to the effect that it would be simpler to take the load on the bottom boom.

If the load is taken on the bottom boom there will be difficulty with the transoms and flooring unless steel beams are used.

The distance between wheel girders is laid down as 8 ft. 6 in. Allowing 9 in. on each side of these the clear span of a transom is 10 ft.

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The greatest bending moment that can be brought on this by the hind wheel of a lorry is 447,105 inch-lbs. equivalent dead load.

Suppose 9 in. × 3 in. is the biggest timber available, then each transom will have to be made up of nine 9 in. × 3 in.

If the load is taken on each panel point we shall have to put a span 81 in. × 9 in. on each point and have heavy roadbearers connecting the transoms.

Or, if the load is to be distributed evenly along the bottom boom the whole floor will have to be of 9 in. × 3 in. bolted up in bundles of nine.

Therefore if timber only is available it appears impractical to carry the load on the bottom boom.

Again if four girders are used it will not be easy to make each one do its fair share of work with the loading on the lower boom.

Of the three girders shown the quickest and easiest to construct is that shown in *Fig.* 8.

In all these examples the factors of safety used are high. It is good enough on long spans to multiply the live load by $\frac{3}{2}$ to reduce it to equivalent dead load.

If sound fir is available it may be safely stressed up to 1,500 lbs. per square inch in tension or compression.

A lattice girder of the type shown in *Fig.* 8 designed (with the above factors of safety) so that four such girders should carry a train of lorries over a 50-ft. span, was experimented with.

A single girder took a central test load of $6\frac{1}{2}$ tons and deflected 3 in. When the load was removed the permanent deflection was $1\frac{1}{2}$ in. The same girder was then tested with a central load of 13 tons and deflected 6 in., taking a final set of 2 in. when the load was removed. The dead weight of this experimental girder was 25 cwt.

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GIRDER BRIDGE TO CARRY SINGLE ROADWAY FOR HEAVIEST MOTOR LORRIES (Crowded).

Four Girders required.

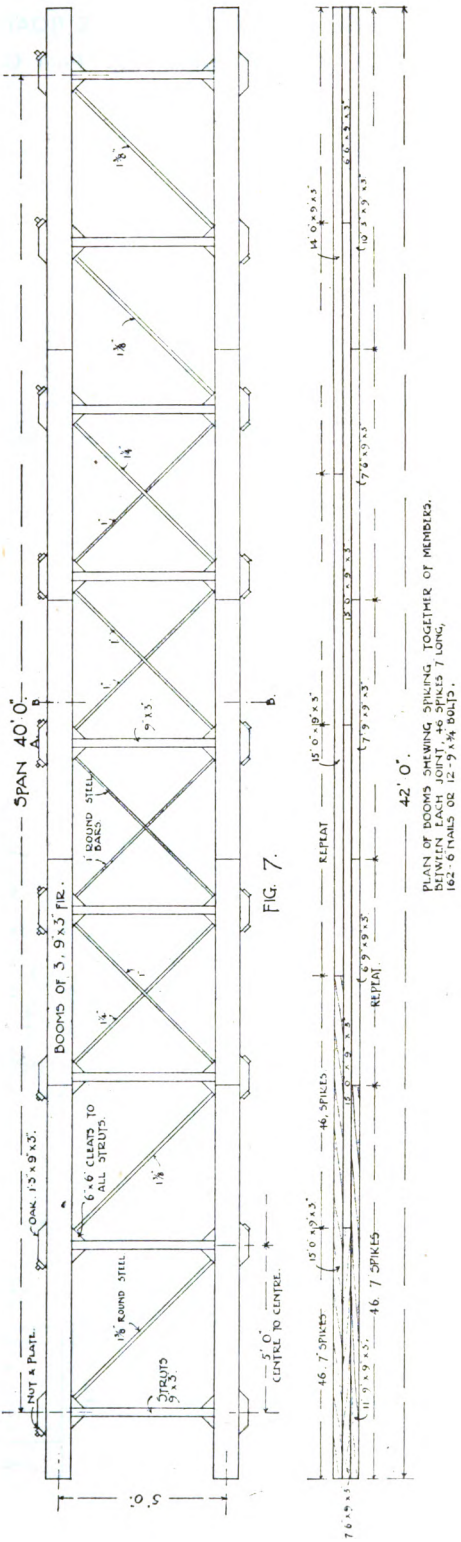

FIG. 7.

FIG. 7a.

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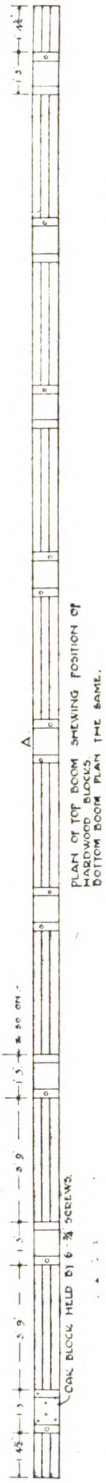
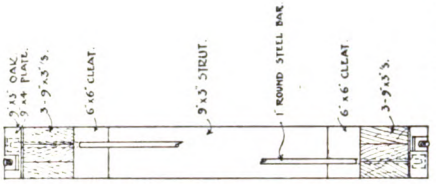
GIRDER BRIDGE TO CARRY SINGLE ROADWAY FOR HEAVIEST MOTOR LORRIES (Crowded). Four Girders required.



PLAN OF TOP BOOM SHEWING POSITION OF HARDWOOD BLOCKS. BOTTOM BOOM PLAN THE SAME.

FIG. 7b.



SECTION ON B-B (FIG 7).

FIG. 7d.

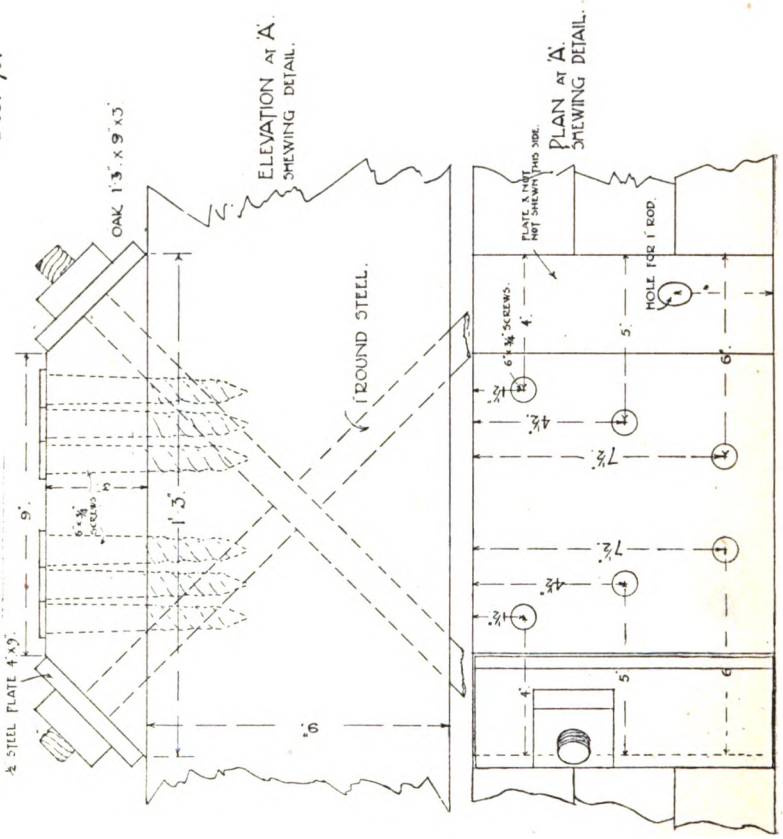


FIG. 7c.

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BRACED GIRDER TO TAKE HEAVIEST MOTOR LORRIES.

Four such Girders used.

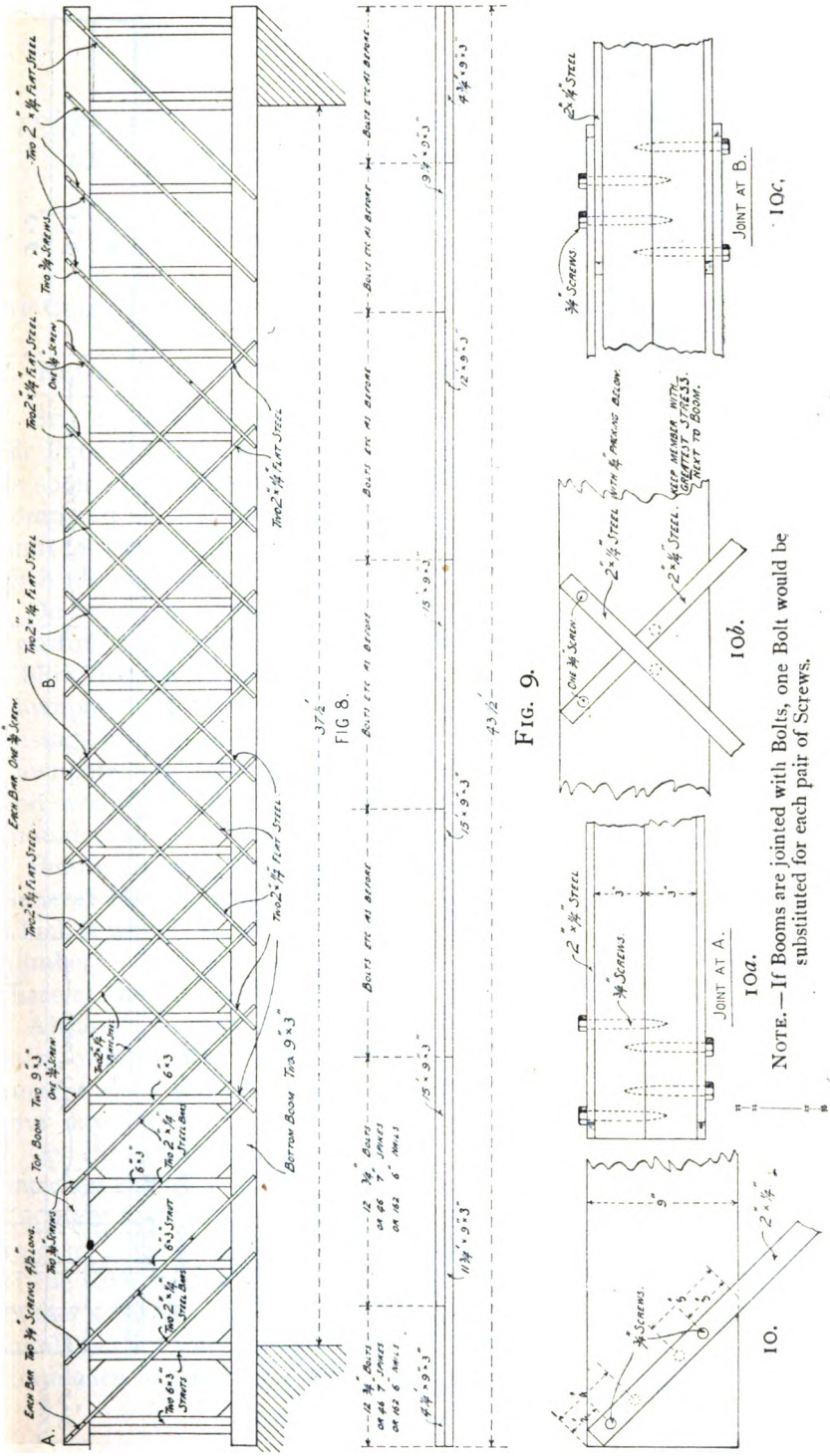

FIG. 9.

NOTE.—If Booms are jointed with Bolts, one Bolt would be substituted for each pair of Screws.

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PART ELEVATION OF PLANK GIRDER.

Four such Girders to carry heavy Motor Lorries over 40-ft. span.

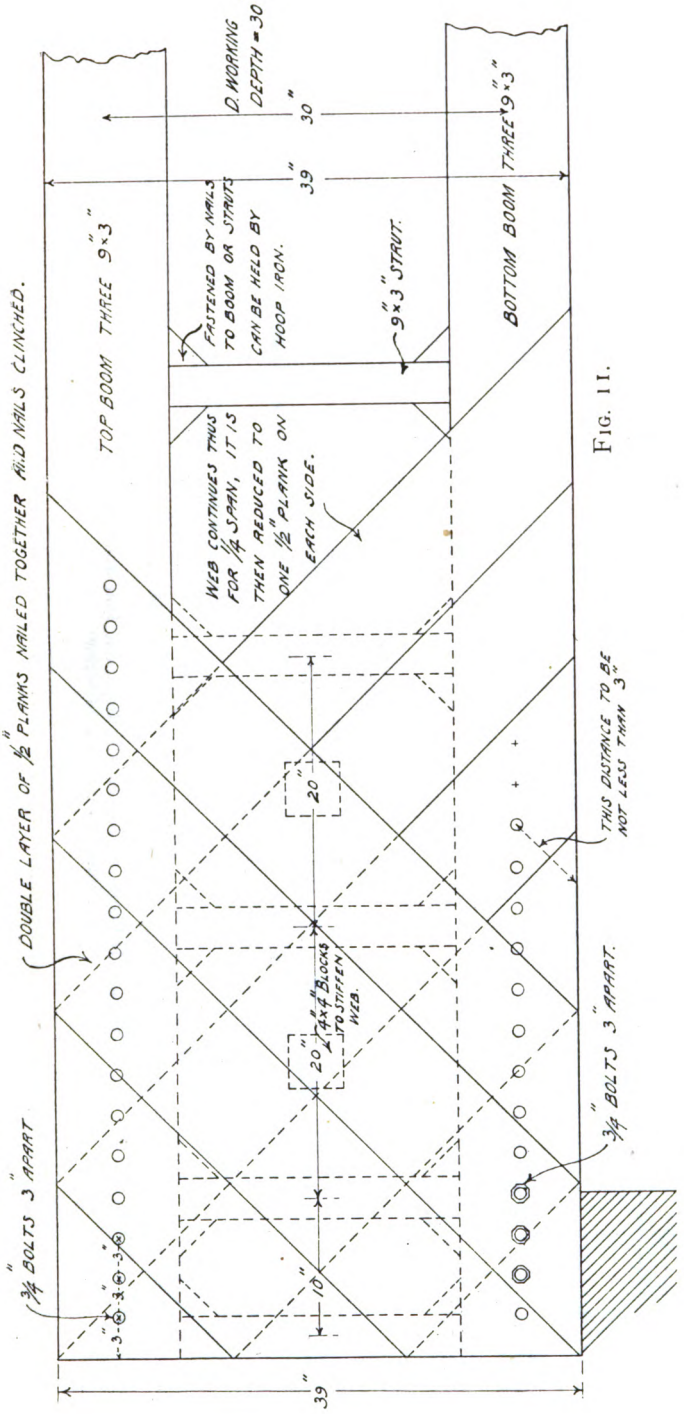

FIG. 11.

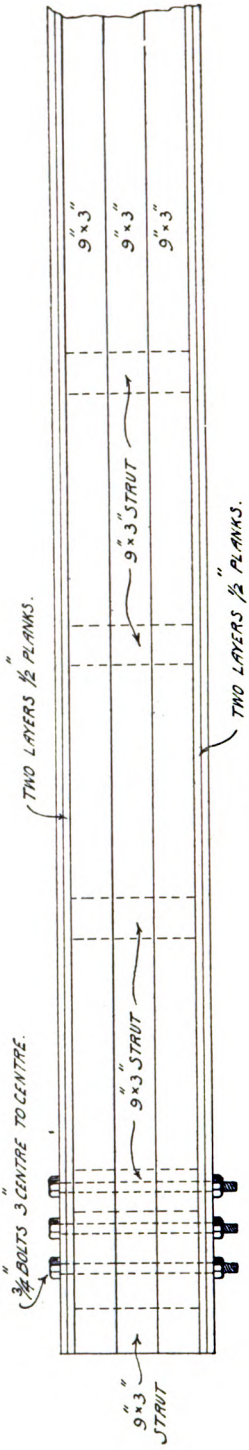

FIG. 12.

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SIEGES AND THE DEFENCE OF FORTIFIED PLACES BY THE BRITISH AND INDIAN ARMIES IN THE XIXth CENTURY.

(*Continued*).

By COLONEL SIR EDWARD T. THACKERAY, V.C., K.C.B. (LATE R.E.).

RELIEF OF LUCKNOW BY OUTRAM AND HAVELOCK, IN 1857.

Brig.-General Neill was pressed by the Commander of the Forces, Sir Patrick Grant, to hasten to Cawnpore to join General Havelock as soon as possible, in order that he might be on the spot to take command of the force should Havelock from any cause become unfit for the duty, and left Allahabad on the 16th July, and proceeding with all possible expedition, reached Cawnpore on the 20th.

On his way General Havelock informed him that he was anxiously awaiting his arrival, as, immediately he did, he intended "to strike a blow that would rebound through India." Neill on his arrival at Cawnpore was informed by Havelock that he intended to begin the passage of the Ganges on the morrow, leaving Neill in command at Cawnpore with about 200 men, the majority of whom were sick and wounded. In this arrangement, Neill anxious that Havelock should take with him every available man, entirely concurred.

Before deciding on making a desperate effort to relieve Lucknow, General Havelock had traced out a position resting on the river, which it would be easy for a small force to hold against very superior numbers. The work was being entrenched and some guns mounted there at the time of Neill's arrival. He was to complete and hold it.

Although General Havelock's force consisted of only about 1,500 men, owing to the breadth of the swollen river, the rapidity of the current alone presented formidable obstacles. The crossing occupied four days.

On the afternoon of the 24th General Havelock crossed, and marched the force about 5 miles on the Lucknow Road, halting for the night at the little village of Mungulwár. The force consisted of 10 guns imperfectly equipped and imperfectly manned; the remains of the 64th, the 84th, the 75th Regiments, the Madras Fusiliers, and of Brazer's Sikhs; and some 60 volunteer horse. Small as were the numbers they were possessed of the best spirit, and had unbounded confidence in their general.

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On the night of the 24th of July this force bivouacked at Mungulwár. It remained halted at the village four days, to enable the General to complete his dispositions for carriage and supplies. On the 28th these had been completed so far as the disorganized state of the country permitted. At 5 o'clock on the morning of the 29th the force began its onward movement. After marching 3 miles the advanced pickets of the enemy were discovered. These fell back as our men pressed on, disclosing the enemy occupying a very strong position. Their main force rested on the town of Oonáo, a straggling place, extending about three-quarters of a mile, and which the heavy rains and the nature of the soil rendered it impossible to turn. In advance of this town, and between it and the British force, was a succession of walled enclosures, filled with skirmishers. These enclosures joined a village united with Oonáo by a narrow passage, and all the houses in which were loopholed and defended.

It was impossible to turn such a position; it was murderous work to attack it in front. But if he was to get on at all Havelock had no option. After a steady reconnaissance, Havelock gave his orders. Covering his main body with skirmishers, armed with the Enfield rifle, he opened a heavy fire from them, and from his guns on the more advanced positions of the enemy. This fire drove them from those positions and forced them to take refuge in the loopholed houses. At these Havelock then sent the 78th Highlanders, and the Madras Fusiliers. Gallantly did they advance. But to dislodge an enemy from loopholed houses, singly, one after the other, is deadly work; Havelock therefore ordered up the 64th. Their advance decided the day. The enemy were either bayoneted in the houses or sought refuge in flight.

But the town of Oonáo was still in the enemy's possession, and, what was of more consequence, fresh troops were observed hastening down the Lucknow Road in its direction. Havelock at once made preparations to meet them. Drawing off his force to a dry spot of ground between the village and the town, he placed his guns in a position to command the high road, by which alone he could be attacked, and waited for the movement of the enemy further to develop itself. In a short time it was evident he would be attacked. The rebels were marching in dense columns upon him. Havelock's joy was great for he felt that he had them. Restraining his impatience until when they were well within distance, he suddenly opened a withering fire upon them from both arms. It stopped them and they attempted to deploy, but on either side of them were swamps and marshes. Consequently, their horses and their guns stuck fast, their infantry floundered. All this time they were exposed to a continuous fire. Meanwhile some of our men, wading in the marshes, made their presence percep-

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tible on either flank. This was the final blow. The rebels gave way, and fled precipitately leaving in our possession 15 guns.

Notwithstanding that he and his men were under the terrible sun of India, he determined to push on after the enemy, as soon as his men should have satisfied the cravings of exhausted nature. He ordered a halt; and while the cooks prepared the food, and the doctors attended the wounded, he had the 15 captured guns disabled as he had no cattle to take them with him.

At the end of three hours the men again fell in, and pushed forwards, always towards Lucknow. They had marched 6 miles, when suddenly they came in sight of a walled town, situated in the open, and intersected by the road which they must traverse. This was the town of Bashíratgunj. It looked very formidable. In front of it was a large pond or tank, swollen by the surrounding inundation to the form of a river. On the Lucknow side of it was another pond or lake, traversed by a narrow causeway. It possessed besides a wet ditch, and its main gate was defended by an earthwork and four guns, and flanked on both sides by loopholed turrets. He poured a tremendous fire on the town, whilst the 64th made a flank movement to his right; then, when he deemed the moment to have arrived, he sent on his infantry to the main gate. But the 64th had not reached the causeway—and the larger body of the enemy escaped across it.

Still the loss of the rebels that day had been severe. It was computed that not less than 400 of them had been killed or wounded. On the British side 88 had been placed *hors de combat*, but two battles had been gained.

But the thoughts of the General that night were not consoling. It was not alone, or even mainly, that his losses in the fight had been heavy, for sickness also had done its work. On the morrow of the two battles he could not, deducting the necessary guards, place in line more than 850 infantry. He knew that in front of him were places to be traversed, or stormed, the means of defence of which exceeded those of the places he had already conquered. Then too he had no means of carrying his sick, and he could not leave them, for he could not spare a sufficient force to guard them. But perhaps his greatest difficulty lay in the fact that every step forwards would take him further from his base, and he had information that that base was threatened. Náná Sahib, in fact, had no sooner heard of the onward move of the British, than he sent a considerable body of cavalry across the river to cut off their communications with Cawnpore. No one can doubt that the resolution at which Havelock arrived on the following morning, to fall back on Mangalwúr, and to ask for reinforcements was the right one. From Mangalwúr it would be possible to send the sick and wounded to Cawnpore without permanently weakening his force. He effected

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this movement the following day without haste, and in the most perfect order. From Mangalwúr he despatched his sick and wounded into Cawnpore, and a letter to General Neill, stating that he had been forced to fall back, and that to enable him to reach Lucknow it was necessary that he should receive a reinforcement of a thousand men and another battery of guns. Neill had assumed command at Cawnpore on the 24th July. He had not been satisfied with the state of affairs as he found them there. The location of the troops appeared to him faulty, the camp pitched without method or arrangement, no effectual steps taken to put a stop to the plundering in the city—a plundering carried on by our European and Sikh soldiers.* His first acts on the 25th were to appoint a superintendent of police, to re-establish order in the city and bazaars, to put a stop to plundering. He announced his assumption of command, and notified the measures above stated in a telegram the same day to the Commander of the Forces, Sir Patrick Grant. The spirit of the man showed itself in the last sentence of this telegram :—" All well here. I will hold my own against any odds."

Not only was Neill aware that Náná Sahib, distant from him but 24 miles, was threatening to cross the river and to attack him, but he had received information that the mutinous 42nd Native Infantry were within 8 miles of the station, and that other native regiments were gradually collecting on the right bank of the Jumna with the avowed intention of making a dash on Cawnpore. But Neill was not disturbed. " If the 42nd are within reach," he recorded in his journal on the 30th, " I will deal them a blow that will astound them." With the levies of Náná Sahib he did deal. On the 31st he despatched a party of 50 Fusiliers and 25 Sikhs, with two 6-pounders, and a 5½-in. mortar, manned by six gunners, under the command of his aide-de-camp, Capt. John Gordon, of the 6th Regiment, Native Infantry, in the steamer to Jajamáo, to seize the boats in which it was reported Náná Sahib intended to cross the river. The party destroyed several boats, carried off six or eight, and returned to Cawnpore the next day.

On the 3rd August Havelock was reinforced by Olphert's half-battery and a company of the 84th. Hopes had been held out to him that the 5th Fusiliers and the 90th Light Infantry would reach Cawnpore early in August. But owing to the mutiny of the regiments at Dinapore these regiments were retained though grievously required to reinforce Cawnpore. The disappointment only roused Havelock to renewed exertion. On the 4th August having then about 1,400 effective men under his command, two heavy guns, (24-pounders), two 24-pounder howitzers, and a battery and a-half

* Private journal of Brig.-General Neill, unpublished.

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of guns, he started a second time in the direction of the besieged Residency. Having heard that the town of Bashíratgunj had been re-occupied in force, he bivouacked that night at Oonáo. Leaving that place early next morning he found the enemy occupying a position very similar to that from which he had dislodged them on the 29th July.

Havelock ordered the advance by the road of the heavy guns supported by the Madras Fusiliers and the 84th Foot, whilst the 78th Highlanders, the Sikhs and Maude's Battery should turn the village on its left. The heavy guns speedily dislodged the enemy from the outer defences. Meanwhile the turning movement greatly disturbed them. Bewildered by the progress it was making, and much embarrassed by the firing in front of them, they were stricken with panic, and fled across the causeway. In their flight across the causeway the rebels came under the fire of the guns of Maude's Battery and were mown down in numbers. The heavy guns continued all this time their destructive fire, silencing the guns of the enemy and forcing them back. The rebels did indeed for some time longer hold villages to the right and left of the town, but in the end they were forced out of these.

Still though the enemy was beaten "the whole transaction" to use the language employed by Lieut.-Colonel Tytler to Sir Patrick Grant, was most unsatisfactory, only two small iron guns, formerly captured by us being taken.

The loss of our force had not been large. Two had been killed and 23 wounded. The loss of the rebels was stated to be 300. But there were weighty considerations to stay further advance, cholera had broken out in the camp and that disease and fever had placed 75 men on the sick list. In the action at Bashíratgunj one-fourth of the ammunition had been expended. Between that town and Lucknow was a deep river, the Saí, and three strong places, guarded it was believed by 30,000 men. The Zemindars, too, had risen in bodies of 500 or 600, independently of the regular troops. "All the men killed yesterday," wrote Colonel Tytler, "were Zemindars." But even were the force able to reach Lucknow what could it effect, enfeebled and worn out against the myriads who would oppose it in the streets? On the morrow of the fighting at Bashíratgunj it was impossible to parade 900 infantry. To what extent would this number be reduced in fighting its way to the Residency?

Intelligence reached Havelock on the 6th that the men of the Gwalior Contingent had successfully mutinied against their own Maharajah, and were threatening to move on Calpee, a position which would threaten Cawnpore, and menace the communication with Allahabad. The intelligence regarding the Gwalior force then brought home to Havelock for immediate decision the question of advance or retreat; the advance could scarcely be

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successful, and yet failure in his opinion involved the destruction of his force, and with it possibly a disaster at Cawnpore. Retreat only risked Lucknow, while an unsuccessful advance subjected Lucknow to a greater risk.

No sensible man will deny that under the circumstances of the case, Havelock exercised a wise judgment in deciding to retire and wait for reinforcements and he fell back on Mangalwár, when he lay there for four days recruiting his men. On the 11th he purposed to recross into Cawnpore, but learning that the rebels had established themselves in considerable force at Bashíratgunj, with advanced parties at Oonáo, prepared to disturb him while crossing, he resolved to anticipate them. For the third time he advanced along the Lucknow Road, pushed the advanced parties out of Oonáo, and bivouacked near that town for the night. At dawn he again attacked the enemy. Under his orders the 78th Highlanders precipitated themselves, without firing a shot, on the earthworks in front, while the Madras Fusiliers, to whom the turning movement had been entrusted, took them in flank. The result was decisive. Two of the enemy's guns were captured and turned on them and they fled in disorder leaving about 200 killed and wounded. Our loss amounted to 35. Having thus scared away the enemy, on the 13th Havelock leisurely fell back, and by 2 o'clock on that day had recrossed into Cawnpore without a casualty. His troops were taken over in the steamers and in country boats towed by the steamers, the current being still too strong to permit the putting together of the bridge of boats for which materials had been prepared.

The private journal of General Neill showed that he still held to his previous opinion that Havelock, in retiring after his first victory on the 29th June, had committed an error which could not be redeemed until he had received large reinforcements. Sir John Kaye in his *History of the Indian Mutiny*, Vol. III., does not concur in this view, and considering the immense temptation to Havelock to advance, the pain which the order to retreat caused him, the historian of the Mutiny cannot but regard his resistance to that temptation as the most heroic act even of his great career.

After the action fought at Oonáo and Bashíratgunj by General Havelock, and after three strenuous efforts to reach Lucknow by the small force under that great General's command, the retirement of the force to Cawnpore in order to await reinforcements was imperative.

Sir James Outram had been sent to Cawnpore to command the force which was to relieve Lucknow. In accepting that command he superseded the man whose daring efforts with an inferior force to effect that relief had won for him the applause and admiration of his countrymen. To the generous nature of Outram, it seemed

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revolting that he should obtain the glory where another had endured the trials and the dangers. He could not do it, and he was determined that it should not be done. Availing himself of the circumstance that whilst from a military point of view, he was commander of the forces about to march into Oudh, he would also enter that country in a civil capacity as its Chief Commissioner, he published, the day of his arrival at Cawnpore on the 16th September the following order:—"The important duty of relieving the garrison of Lucknow had been first entrusted to Brig.-General Havelock, C.B., and Major-General Outram feels that it is due to that distinguished officer, and to the noble and strenuous exertion which he has already made to effect that object, that to him should accrue the honour of the achievement. Major-General Outram is confident that the great end for which Brig.-General Havelock and his brave troops have so long and gloriously fought will now, under the blessing of Providence, be accomplished. The Major-General, therefore, in gratitude for, and admiration of the brilliant deed of arms achieved by Brig.-General Havelock and his gallant troops, will cheerfully waive his rank in favour of that officer on this occasion, and will accompany the force to Lucknow in his civil capacity as Chief Commissioner of Oudh, tendering his military services to Brig.-General Havelock as a volunteer. On the relief of Lucknow, the Major-General will resume his position at the head of the force."

On the 17th General Havelock found waiting him on his return from a successful expedition to Bithoor, and after the capture of that place, a copy of the *Calcutta Gazette* dated the 5th August, containing the nomination of Major-General Sir James Outram to the military command of the country in which he was operating. He learned in fact that he was superseded. He received this information from the *Gazette* alone. It was accompanied by no communication to break the news. He received the bald announcement only. Superseded as he regarded himself to be, he was as active, as daring, as devoted, as when he ruled, the unfettered commander of an independent force. Never indeed was the exercise of the great qualities of resolution and energy more needed than after his return from the expedition against Bithoor. Out of 1,700 English troops whom he had altogether under his orders from the time of his quitting Allahabad, but 685 remained effective.

Not only was he now compelled to abandon for the moment all idea of re-crossing into Oudh, but the action of the Gwalior Contingent threatening Calpee, rendered it doubtful if he could even hold Cawnpore. Were Calpee to be occupied by this force, consisting of 5,000 disciplined men with 30 guns, his communications with Allahabad might at any moment be cut off.

To the north, the Nawáb of Furruckábád was ready with 30,000

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men—some sepoys, some raw levies—to take advantage of any difficulty which might threaten Cawnpore. It was too, in the power of the rebels in Oudh to cross the Ganges at any point below Cawnpore, and acting singly or co-operating possibly with the Gwalior troops, to endanger his communications. Of all these dangers Havelock had the fullest cognizance. Yet his judgment was never clouded. To remain at Cawnpore was undoubtedly a risk, but to fall back on Allahabad would have been a calamity. He resolved then to hold Cawnpore as long as possible and to await the reinforcements which were on their way.

(*To be continued*).

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REVIEWS.

HISTORY OF THE CORPS OF ROYAL ENGINEERS, VOL. III.

By COLONEL SIR CHARLES M. WATSON, K.C.M.G., C.B., late R.E.—(Price: Members of the R.E. Institute, 7s.; Non-Members, 10s. 6d. R.E. Institute, Chatham, 1915).

THE Council of the R.E. Institute was well inspired in deciding that the time had come for bringing the history of the Corps up to date. They were only just in time, for the work was practically finished in July of last year. It would not have been possible to have carried it on during the stress of the present war, and the share of the Royal Engineers in this war will need a volume to itself. The Council was equally fortunate in securing so competent an historian as Sir Charles Watson. He is not only distinguished both as a soldier and a writer; in dealing with parts of his subject he speaks with special knowledge and exceptional authority. For instance, his account of the Sudan Campaigns from 1885 to 1899 is masterly. Brief as it is, he brings out the character and connection of the operations which led up to the recovery of the Sudan; at the same time he does not forget that he is primarily concerned with the doings of the Royal Engineers. As a subaltern he had served under Gordon in the Sudan, and in 1882 he led the British cavalry into Cairo after Tel-el-Kebir. But for more than 10 years (1891—1902) he was employed at the War Office in connection with the Barrack Loans, and this enables him to write a chapter on "Barrack Works," which is the most valuable chapter of the book.

General Porter, who brought the history of the Corps down to 1886, had a large field to cover, but it is surprising that he should have made hardly any allusion to barracks, with which the Corps has had so much to do. Sir Charles Watson wisely decided, therefore, to begin at the beginning in this case, instead of confining himself to the last 30 years. During the 18th century, owing to the antipathy to a standing army, barracks were practically unknown in England except in garrison towns. There they might be said to form part of the defences, and were built and maintained by officers of Engineers under the Board of Ordnance. At the beginning of the great war, in 1793, Pitt realized that billets and encampments would no longer meet the case, and took in hand the provision of barracks on a large scale; but instead of entrusting the work to the Board of Ordnance, he created a new office, that of Barrack-Master-General, to which he appointed Colonel Oliver De Lancey, who was at that time Deputy-Adjutant-General. This officer undertook the work of barrack construction on the express stipulation that he was not to become a public accountant. All payments were to be made by the officers commanding the troops on the spot. At the end of ten years or so it was found that over nine millions

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of money had been spent, but the accounts had not been audited and could not be cleared up.

Mr. Clode suggests in *The Military Forces of the Crown* that the object of this singular arrangement was to withdraw a large expenditure from the control of Parliament, the cost not being submitted in estimates, but charged to what was called "the Army Extraordinaries." But it seems not improbable that it was largely a personal matter. The Duke of Richmond, who was Master-General of the Ordnance at that time, had many enemies, who—as General Porter showed (Vol. II., p. 210)—succeeded in wrecking his proposals for the defence of Portsmouth and Plymouth. In dealing with a matter on which public feeling was so readily inflamed as that of barracks, Pitt and Dundas may well have thought it best not to connect it with so unpopular and so headstrong a person. But whatever the motive, there can be no question that the method adopted led to great waste of public money, and that the Duke of Wellington did well when, in 1822, he brought about the transfer of the barracks to the Board of Ordnance.

In 1855, when things were going badly in the Crimea, that Board itself was swept away, much to the regret of many able officers. Now that we are creating a Ministry of Munitions to meet an emergency, one cannot help asking oneself whether the Board of Ordnance might not have been remodelled, instead of destroyed. At all events it is interesting to read the evidence given by the Duke of Wellington and Lord Hardinge before the Commission which reported in 1837 on the civil administration of the army. They put the case for the Board so forcibly, and with so much personal weight, that the schemes for consolidation were postponed for nearly 20 years.

But the chapter on Barrack Works is not concerned only with ancient history. The particulars given of recent barrack construction and of the successive loans providing for it are most valuable.

More than 50 pages of the book are devoted to the South African War, and these can only be made to cover the varied work of the Corps in that long struggle by severe compression. They tell all that is strictly necessary for the purpose, but it would have been a good thing to supplement them by references to more detailed accounts of particular sides of the work, such as Colonel Bethell's paper on the Blockhouse System in Vol. XXX. of the *Occasional Papers*. The changes in the organization of the Corps and in the regimental units are carefully registered, and those chapters give information which would be sought in vain elsewhere, and must have cost much labour. The same may be said of the list, running to 20 pages, of R.E. officers who have been employed in various departments of the State on other than Corps duties. Service in India is not included. It is mentioned in the preface that the work done by the Royal Engineers in India during 1886—1912 has been so important as to need a separate volume, written by an officer who has served in India. As regards professional work the omission seems warranted; but in the list of employments it seems needless to suppress the fact that Lord Kitchener was Commander-in-Chief in India as well as in Egypt, and that Lord Sydenham was Governor of Bombay as well as of Victoria.

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The volume ends with short biographies of 30 distinguished officers whom the Corps has lost during the period dealt with, and here Indian Engineers have not been excluded. The biographical sketches were an excellent feature of General Porter's history, and they are well supplemented by Sir Charles Watson. He has had the help of the obituary notices which have appeared from time to time in the *R.E. Journal*, and of the memoirs written by Colonel Vetch for the *Dictionary of National Biography*. Special mention may be made of the sketches of Sir Lintorn Simmons, Sir William Jervois, Sir Gerald Graham, and Sir Charles Wilson.

The Corps is greatly indebted to Sir Charles Watson for having undertaken so laborious a task, and executed it with so much ability and success.

E. M. LLOYD.

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PAGES D'HISTOIRE, 1914—1915.

(Librairie Militaire Berger-Levrault, Paris: 5, Rue des Beaux-Arts).

THE Librairie Militaire Berger-Levrault has, since the beginning of the year, altered the main title of its *Pages d'Histoire*, 1914, series of pamphlets to correspond with historical facts. The first 30 numbers were published in 1914 and complete the issues of that year; these numbers have already been reviewed in the *R.E. Journal*. The 31st number is the first of the issues for 1915.

The 31st and 33rd numbers are in continuation of the 11th, 13th, 14th, 16th, 17th and 19th numbers of the series published in 1914 and deal with mentions in dispatches, and awards of the Legion of Honour and the Médaille Militaire; the 31st number covers the period 11th to 21st November last, and the 33rd number covers the period 22nd to 25th November last.

The 32nd number contains a technical description by M. Th. Schlœsing, Junr., of the now famous "75" gun with which the French Field Artillery is armed and also of the carriage and the ammunition for the same; diagrams are provided of the more important details described. The most important feature of the gun is naturally the breech-piece, a full description of which is given. The gun-carriage is provided with a cradle, firmly attached thereto, in which the gun recoils freely on discharge. An important feature of this mounting is the hydro-pneumatic energy restorer which, on the discharge of the piece, permits the energy of recoil to be utilized for the purpose of automatically restoring the gun into the firing position directly it reaches the extreme limit of its rearward travel—a distance of 1·20 metres. The details of the hydro-pneumatic restorer were kept secret before the outbreak of the present war and are not described; however, since the Germans captured some "75" guns in the early days of the war the great secret relating to the French field piece has now been disclosed to them. In order to provide an immobile platform for the cradle in which the gun itself is mounted, in addition to the spade attachment fitted to the trail piece of the gun-carriage, special brakes having sharp projections on their exterior are also supplied. When the gun is in action these brakes are brought under the wheels of the gun-carriage and with the aid of the trail-piece spade attachment permit the gun-carriage to be firmly anchored in the ground. The weight of the gun, with its moving parts, is 500 kilogrammes (about 1,102 lbs.) and on the discharge of its projectile—weighing 7·24 kilogrammes (about 16 lbs.)—the maximum velocity of recoil is calculated to be 9 metres per second, so that the period which elapses between the discharge of the gun and the moment that it has been restored to the firing position, after recoil, is measured in parts of a second only. The cradle for the gun is pivoted on the axle of the carriage so as to admit of its traversed in azimuth through a small arc.

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To facilitate the laying of the gun on targets situated on any horizontal plane, different to that passing through the points of support of the cradle in which it is mounted, the elevating gear provided is of the type known as "independent," that is to say, this gear is not directly attached to any part of the tube from which the projectile is ejected. Another of the special features in connection with this gun is the appliance provided for setting the time fuzes; an illustrated description of this appliance is given.

A comparative table, in which the principal details of the French "75" and the German "77" gun are set out, concludes the description of the French field piece. Actual experience, in the present war, has proved that the French field gun is immeasurably superior to the German one.

The 34th number of the series is entitled *The Germans in Belgium* and contains the experiences of Mr. L. H. Grondijs, a Dutch subject, who visited Brussels, Louvain, Aerschot and other centres during the early days of the war. He arrived at the Belgian capital on the 19th August last; on that date the Civic Guard in this city had already been disbanded and the high-power wireless station, only very recently erected, in the Palace grounds at Laeken for the purpose of establishing telegraphic communication with Belgian Congo had also been destroyed by the Belgians. On the 21st August, Mr. Grondijs set out on foot for Louvain, but he had only reached the village of Tervueren when he encountered German troops on the march to Brussels. He was allowed to proceed to Louvain; on his arrival there he found a state of things providing evidence of the great relaxation which had taken place in the discipline of Germany. He testifies to the fact that the Belgian people had continued to behave in a perfectly correct manner, in spite of the provocation experienced by them, and gives many details of the arbitrary conduct of German officers, non-commissioned officers, and men; examples are also quoted of the nature and extent of the excesses committed by the German soldiery against the civil population of both sexes and of all ages. The sack of Louvain is described and an attempt is made to trace the causes which may have moved the Germans to act as they did. He attributes the misbehaviour of the German soldiery to religious bigotry and, in support of his view, directs attention to the fact that a great deal of the German violence was specially directed against Papists. Several instances are recorded in which Roman Catholic priests were purposely singled out for brutal maltreatment. Mr. Grondijs returned to Holland *viâ* Aix-la-Chapelle on the 29th August last, after having been in collision with German officers more than once.

The 35th number is in continuation of the 6th to 8th, 12th, 18th and 26th numbers and contains the official communiqués, etc., sent to the Provincial Authorities by the Central Government during the month of January. In an appendix are given summaries of the principal events of the war during the month; the first of them deals with the period 5th—15th January and the second with the period 16th—26th January.

The 36th and 37th numbers of the series contain extracts selected from current publications voicing the opinions of many prominent

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Americans on the subject of the present war. In a preface to the first of these numbers it is pointed out that Germany has left nothing undone since the beginning of the war to win over American opinion to her side. The German Ambassador at Washington, the ex-Minister Dernburg, and Professor Kuno Meyer have, among other writers, applied themselves with German thoroughness to promote the interests of their Fatherland by taking part in a widespread publicity campaign. Two factors existing in the United States of America appeared at the commencement of the war to be such as to tell in favour of the German cause, namely, the fact that 20 per cent. of the population inhabiting the land of the star-spangled banner are of German extraction, and the presumption that, among the people of Irish extraction owing allegiance to the Great Republic, there existed a large proportion who have not forgiven, and could never forgive, Great Britain for the treatment meted out to Ireland in times gone by. The failure of this publicity campaign is now patent, and the cause of the failure can, according to the *New York Herald*, be summed up in one single word—"Belgium." In thoughtful American circles, it would appear, the question is no longer whether Germany is in the right or in the wrong, but rather, how far would it be politic for the American nation to take steps to bring home to Germany that she is in the wrong. It is suggested that President Wilson regards the maintenance of a very strict neutrality on the part of the American Government and people of paramount importance; not only does he continue to hope that far-reaching advantages will accrue to his country by reason of the adoption of this course, but he further anticipates that the assumption of this attitude in his country will, when the opportune moment arrives, enable him to play the part of Peacemaker in Europe. It is pointed out also that ex-President Roosevelt insists, on the other hand, that the United States of America, having become a co-signatory with the belligerent powers to the provisions of the Hague Conventions, ought now to intervene in order to obtain from Germany respect for and compliance with those solemn obligations to which she was a party and is now ruthlessly disregarding. The ex-President does not advocate a resort to arms, but inclines to the view that diplomatic pressure will produce the desired result. Many of the 17 extracts contained in the 36th number are culled from the *New York Nation*, the great liberal periodical published in the commercial capital of the great Republic.

The first of the extracts in this number consists of an appreciation of the late Archduke Francis Ferdinand contributed to the *New York Nation* of 30th July, 1914, by Mr. Henry S. Pratt. The author of the article points out that the late Archduke was as unpopular in his own natal town as in the other parts of Styria, in which the population is largely German. The reason given for this unpopularity is that the late Archduke favoured Slav rather than German interests, and further, being under strong clerical influences, he was imbued with ideas hostile to liberty. Nevertheless, even those who loved the late Archduke least experienced sincere regret on learning of his assassination; they recognized that he had many qualities requisite in a leader of men and was possessed of good intentions.

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In another of the extracts (taken from the *New York Nation* of 6th August, 1914) is discussed the subject of "The Responsibility for the War." The opinion is expressed therein that the entry of German troops into Belgium and the Grand Duchy of Luxemburg was nothing less than direct defiance to Great Britain and by these acts alone Germany placed herself in the position of an outlaw among the nations of the world. It is suggested that even if the German Emperor did not actually let loose the dogs of war, nevertheless he failed to hold them in check on the leash; a thing he could easily have done had he been so minded. It is recognized that whatever may be the outcome of the present struggle, neither Europe nor the disciples of humanity can possibly allow a return to a state of things whereby three crowned heads, bound by a pact, can again give the signal for the massacre of human beings and the destruction of private and public property—quite irrespective of whether they are actuated by good intentions or whether they merely allow themselves to be carried away by caprice.

The extract which succeeds the foregoing is taken from the *New York Nation* of 24th December, 1914, and is entitled "The Neutrality of Belgium." It constitutes a reply by Mr. E. H. Turner to certain views expressed by Professor John W. Burgess, of Columbia University, on the subject of the violation of the neutrality of Belgium. The Professor recently stated that, in 1870, the British Government was in doubt as to whether the Treaty of 1839 guaranteeing the neutrality of Belgium still remained in force. He draws attention to the fact that not only have political changes of considerable importance taken place which have altered the face of Europe during the latter half of the 19th century, but also to the fact that the British Government entered into separate treaties with the North German Confederation and also with France at the outbreak of the Franco-Prussian War. The terms of these two treaties were identical, and provided that the neutrality of Belgium should be respected by each of the belligerents during the period over which hostilities might extend and for one year more beyond the date of the termination of the war. Professor Burgess argues that the foregoing treaties (entered into in 1870) expired by effluxion of time in 1872, and states that, since the foundation of the present German Empire, the Imperial authorities have never pledged themselves by treaty to respect the neutrality of Belgium. Mr. Turner, in his reply, calls attention to the fact that, in 1870, both Earl Granville in the Lords and Gladstone in the Commons declared in clear and unmistakable language that the Treaty of 1839 had in no way lost any of its force or validity by reason of the conclusion of the two treaties entered into between Great Britain and the belligerent Powers in relation to the neutrality of Belgium. He further points out that the whole world, even including Germany itself, has never been in the least doubt as to the obligations of the German Empire with regard to Belgium; so clearly indeed did the German nation recognize their obligations in this matter that the Imperial Chancellor when addressing the Reichstag in August, 1914, without hesitation openly admitted that the violation of the territories of the Grand Duchy of Luxemburg and of Belgium were acts contrary to International Law and excused these acts on the ground that necessity recognized no laws.

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In another of the extracts taken from the *New York Times* of 8th November, 1914, the views are given of ex-President Roosevelt as to the possibility of applying the principle of the "Posse Comitatus" in relation to international affairs. Among the other extracts published in the 36th number, one deals with "The Neutrality of Italy" and another with "The Neutrality of Roumania."

The 37th number contains eight extracts, which are preceded by a Preface from the pen of Mr. F. W. Whitridge, the Editor of the *New York Nation*, and in it is discussed the question as to which of the belligerents was really responsible for starting the present war. The opinion is expressed that no American jury, except perhaps one empanelled from the jury lists of either Hoboken or Milwaukee, would for a moment hesitate in returning a verdict that Germany alone was the aggressor. The illusions under which German diplomats appear to have been suffering, prior to August, 1914, with regard to the state of preparedness of the French and Russian Armies, and the relation of Great Britain with Ireland, India, and her Colonies are also examined; and finally, after drawing attention to the nature of some of the appeals made to America by Germany, the Preface is closed with the reply of America. In this reply, Germany is called upon to hearken to the prayers of a nation whose millions express their unalterable desire that the present war, when brought to a conclusion, shall be productive of the following results, namely:—That the German people shall henceforth renounce their false gods; that they shall turn their assiduous attention to their own home affairs—these affairs being on a sufficiently large scale and important enough to engage the whole of their attention and energies; that they shall give back to the world the Germany of Luther, of Beethoven, of Goethe, of Schiller and of Kant; that they shall finally persuade themselves to recognize that their destiny in this world is not to conquer other peoples and races, but rather to elevate the minds of these other peoples and races—a beneficent occupation which has been industriously pursued for a thousand years and more by people of their origin.

The extracts contained in the 37th number are of considerable interest; one of them, taken from the *New York Nation* of 24th September, 1914, describes the working of the "German machine" during the days preceding the retreat from the Marne. Within the space of seven days the great German General Staff set in motion some four millions of men, and a nation at peace with the world became a nation at war with three powerful belligerents; the components of the military machine moved with the smoothness of an accurately balanced engine and with the regularity of a good timepiece; there was not a single hitch in the carrying out of the programme drawn up by the Great General Staff. Hundreds of workshops ceased producing articles normally required for civilian consumption; these hives of industry were at once placed under the orders of the Great General Staff and, without loss of time, the energies of the workers, not absorbed into the ranks of the field armies, were diverted to the manufacture of uniforms, boots and other munitions of war required by the troops sent to the front. Metals and other materials of military value were commandeered on a considerable scale and paid for in cash. The German troops were soon in collision

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with their adversaries. Astonishing as was the nature of the early successes obtained by the German Army, nevertheless this incredibly efficient machine, when on the point of putting the finishing touch to its career of great accomplishments, failed to effect its great purpose; it neither captured Paris, nor surrounded the Allied Armies with a wall of steel, nor did it maintain itself in the advanced positions which it had reached in Northern France. An explanation of this failure is sought, and it is suggested that those responsible for making the most efficient use of the "Great Machine" overlooked the fact that its parts were made up of flesh and blood, parts which had not the same qualities of resistance and hardness as mere inanimate materials. It may be that the complete physical exhaustion of the German troops, more than anything else, was responsible for bringing the wave-like onrush threatening to engulf Paris to a standstill. The opinion is expressed that this extraordinary machine is far from destroyed yet; with foresight and patient labour the Great General Staff has made provision for meeting many vicissitudes. The German leaders are now fighting for the safety of their Empire, and this incentive may still cause miracles to be effected with the "Great Machine." Among other extracts contained in this number, one deals with economic doctrines bearing on the war, whilst another discusses General von Bernhardi and the theories of war disclosed in his writings.

The 38th number of the series is a reproduction of the Second Russian Orange Book and contains the diplomatic correspondence relating to Turkish affairs. It contains copies of 98 dispatches, the first of them dated 1st August, 1914, and the last of them 1st December, 1914. In the first of the dispatches contained in this correspondence, the Russian Ambassador at the Turkish capital informs his Government that the Grand Vizir had confidentially mentioned to him that the Austrian Ambassador at Constantinople had endeavoured to force Turkey to act in concert with Austro-Hungary and to support the latter's policy. The Grand Vizir also stated, at the same time, that he had resisted the pressure exerted on him, in view of his conviction that in the interests of the welfare of his country it was essential for Turkey to avoid participation in the conflict impending in Europe, in spite of the desire of members of the young Turkey party to compromise their Government in favour of the Triple Alliance. Events moved apace in the near East and on the following day—2nd August—the Russian Ambassador telegraphed to St. Petersburg that the Grand Vizir had that day, on being questioned on the subject, admitted that a mobilization of the Turkish Army had been ordered and, at the same time, had explained that the concentration of 200,000 men in Thrace and on the Bosphorus which had been ordered was a purely defensive measure dictated by fears regarding the intentions of Bulgaria. The Grand Vizir further stated that his Government had no intention of effecting any concentration on the Caucassian Frontier. In a second telegram sent on the 2nd August, the Russian Ambassador informed his Government, that in view of the explanations offered by the Grand Vizir, he himself was of opinion that Turkey would only remain neutral so long as it suited her purpose and that he felt the Turkish Government had firmly resolved to take advantage of the European situation, at the opportune moment, in order to

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obtain a modification of the Treaty of Bukharest at the expense of Bulgaria. The correspondence shows that the Russian Foreign Office had received information on the 8th August that the *Goeben* and the *Breslau* were doubling Cape Matapan with the object of entering the Dardanelles; in consequence of this report, instructions were at once telegraphed to the Russian Ambassador requesting him to take immediate steps in concert with the British and French Ambassadors at Constantinople to point out to the Sublime Porte the serious responsibility which would be incurred if Turkey allowed German war vessels to enter the Dardanelles. In subsequent telegrams, reference is made to the alleged purchase by Turkey of these two ships, and the thoroughly Oriental methods of evasiveness adopted by the Turkish Government in dealing with the situation created by the entry of these German vessels into waters under the jurisdiction of the Sublime Porte are fully set out; the fact is also disclosed that both the ships arrived in Turkish waters in a damaged condition. The Russian Government was not desirous of involving Turkey in the great conflagration and on the 10th August a telegram was sent to the Russian Ambassador at Constantinople instructing him to maintain a strictly friendly attitude towards the Ottoman Government but, at the same time, it was desired that he should impress upon the Turkish Ministers how seriously they would jeopardize the continued existence of Turkey as a European Power by the adoption of a line of action which did not conform with the views of the Entente Powers. Nevertheless, by the 20th August the situation within the Ottoman Empire had become extremely serious; so much so indeed that the Russian Ambassador reported to his Government, on the date in question, that the military had taken charge of everything and that, instigated by German officers who appeared intent on dragging Turkey into the war, the Turkish soldiery had become most arbitrary in their conduct and dealings.

The correspondence further discloses the fact that on the 8th September the Russian Ambassador had obtained information regarding the intentions of the Ottoman Government to annul the Capitulations, and two days later he announced to his Government that the Grand Vizir had delivered identical Notes to all the diplomatic representatives accredited to Sublime Porte declaring the intention of his Government to annul the Capitulations as from the 1st October, 1914. In order to justify this action, the Sublime Porte took up the attitude that the Capitulations consisted of concessions which the Sultan had made voluntarily to foreign Governments and could, therefore, be annulled whensoever he might think fit. On the 10th September, all the Powers, including Germany and Austro-Hungary, handed in protests in identical terms objecting strongly to the annulment of the Capitulations. Subsequent telegrams, however, indicate that Germany and Austro-Hungary withdrew their protests. The Ottoman Government later endeavoured to enter into negotiations with the Entente Powers in relation to the Capitulations with a view to introducing some modifications therein, in the event of an agreement being reached, whereby the nationals of the Powers interested would be made subject to the same fiscal laws as the subjects of the Ottoman Empire.

On the date last mentioned, the Russian Ambassador sent a second

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telegram in which he informed his Government that he had learnt from a reliable source that Enver Pacha had, five days earlier, received a communication from the German Ambassador at Constantinople informing him that the Wilhelmstrasse was of opinion that the time had arrived for Turkey to play her part definitely as an ally of Germany. Financial difficulties alone seem to have created, at this time, the serious obstacle which prevented Turkey in completing her arrangements to join the Mid-Europe Powers. Matters dragged on for some time longer and the diplomatic correspondence clearly reveals that Turkey, during this period of suspense, lost practically all power of independent action. On the 16th October the Russian Ambassador telegraphed to his Government that he had learnt, through a reliable source, of a meeting which had taken place at the German Embassy on the 11th *idem*, at which Enver Pacha and Talaat Bey had been present. Further that at this meeting an agreement was signed whereby Turkey undertook to commence warlike operations against Russia in consideration for financial assistance to be provided by the German Treasury. The Ottoman Government took the final step which was to involve its people in the Great War on the 29th October.

On the date last mentioned Odessa and the undefended Port of Theodosia were bombarded by Turkish war vessels, and although the Grand Vizir at first offered apologies for these belligerent acts, later he alleged that the rupture of friendly relations with the Entente Powers had been provoked by hostile acts on the part of the Russian Navy. The final dispatch of the series is one from the Russian Ambassador to his Government dated 13th November, 1914, in which he sums up the nature of the German intrigues in Turkey which are likely to prove the ruin of the latter country.

The 39th number contains 32 sketch maps of the western and eastern theatres of war showing the positions reached by the German advance at various dates. On the first of the sketch maps of the western theatre is depicted the line occupied by the German front on the 10th August, and on the last of them is marked the line held by the Germans on the 31st December, 1914. In the case of the maps relating to the Eastern Theatre,on the first of them is indicated the line occupied by the German front on the 10th August, whilst on the last of this series is shown the line held by the German forces on the 30th December, 1914.

The 40th number of the series contains extracts from the sayings and writings of Germans belonging to every intellectual class of society. The extracts are preceded by a preface written by Abbé E. Witterlé, an ex-member of the Reichstag, and in it he points out that those who will take the trouble to examine the views to which prominent Germans have, at various times, given expression and to extract therefrom the pith and marrow of that which appears to have been most seriously preoccupying their imagination, cannot fail to be struck with the single theme on which one and all harp with persistent reiteration: German hegemony throughout the universe; the all-pervading domination throughout the ends of the earth of the chosen people of the modern world. And in every case the methods advocated for accomplishing the great purpose are identical: resort to terminological inexactitudes,

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the holding in contempt of the rights of others, violation of the national word of honour, the cult of savagery of the blackest order. Providentially German calculations have proved faulty and in consequence their plans have gone awry; nevertheless the indiscreet utterances of the leaders of the German nation are on record. The Abbé expresses the opinion that these utterances will, in future ages, come to be regarded as the unperishing stones which the would-be constructors of a greater Germany used in the building of a monument erected by them as a memorial to the saucy arrogance and smug satisfaction of a crazy nation.

The contents of this number are arranged in chapters, the first of which is entitled, "The Word of the Kings of Prussia," and contains the principal articles of the Treaties guaranteeing the neutrality of Belgium and that of the Grand Duchy of Luxemburg. The subsequent chapters contain extracts from the sayings and writings of the Imperial Chancellors, of philosophers, of professors, of military writers, and of intellectuals; the extracts being grouped according to the calling or profession of each of these several classes.

The final chapter is entitled "The Words of Witnesses" and contains documentary evidence, wholly German, from which is learnt the conceptions regarding truth and the description of humanity to which the "kultur" of the Teuton race has, in modern times, given birth. The editors of this number of the series being desirous that opinions may be formed independently concerning the thoughts, ambitions, and philosophy of the important classes composing the German nation have merely collected together in one volume the actual language employed by the representatives of these classes in their utterances of a public nature and have refrained from adding criticisms or comments on the extracts published. One of the earliest extracts in this series is an excerpt from a letter from Frederic II. to his Minister of State, Podzwill. The august monarch in this letter instructs his Minister in the following terms:—"If our object is to be gained by acting honestly, we will do so; on the other hand, if deception is necessary to attain our end, then by all means let us become knaves."

In this collection is to be found Bismarck's own account of the part he played in connection with the candidature of a Hohenzollern Prince to the Spanish throne; he tells of the pains he took to ensure that the alteration in the terms of the now famous "Ems Despatch" should be such as to ensure a popular outburst in France, the consequences of which must lead to a rupture of friendly relations between France and Germany. Quotations are given showing that the intellectual leaders of Germany have even in recent times approved of the action taken by the Iron Chancellor; in one of these Delbrück puts his views on record bluntly and tersely in the phrase, "Blest be the hand which falsified the Ems Despatch." This contains the reflection of the opinions of others who give a more wordy expression to their thoughts. A striking extract is given from the views of Professor Lasson on "War and the Ideal of Culture" published in 1868. The following are some of the more remarkable expressions of opinion contained in this extract: "Absence of preparation for war in a country is sign of the physical and moral decadence of its people. . . . The development of the

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technique of war is never labour lost. . . . The gun is the most efficient tool for carrying on of the trade of a weaver (in international politics). . . . Whatever may be the nature of the progress of intelligence, of the material and moral conditions of a people, not possessing the possibility of self-defence and of assuring results acquired, all their labour is vain, and this nation can serve no more useful purpose in this world than that of playing the part of a dung-heap on the field of culture of more vigorous people." In this extract the author explains in what sense he employs the word "culture." He states: "Civilization is the general progress of humanizing influences over barbarism. Culture is the individual form that this civilization takes in the case of any particular people. Diverse forms of culture mutually oppose one another; each form menaces the others, for each is believed to be the true and perfect form and its votaries strive to extend its influence. . . . Every war arising out of reasonable causes must be carried on by each belligerent according to the forms of culture adopted by its country."

Copies are also given of two letters dated Berlin, 29th and 30th September last, from the pen of Lasson which appeared in the *Amsterdammer*, a Dutch weekly review, of 11th October, 1914. In the first of them the writer states: "A man who has not German blood in his veins can know nothing of Germany. We are morally and intellectually superiors of all others and without a compeer. It is the same with our organizations and institutions." Then follow adulatory phrases concerning William II. and von Bethman-Hollweg; a defence of the destruction wrought at Louvain by the German hordes; an expression of the opinion that "England goes to her ruin, though France may yet be saved" and that Russia shall no longer remain a contiguous neighbour of the German Empire; the determination is expressed that after the war Germany will start with a *tabula rasa*. The writer concludes this letter with the customary German assurance: "God is with us and is defending our just cause."

In the second letter, Lasson alleges that the Germans are powerfully armed, partly to afford Holland protection, and to this fact it is due that this small kingdom has been enabled to lead a quiet existence and amass wealth. He declares that Holland is only a dependance of Germany and gives vent to veiled threats against the Dutch, since they are suspected of hostile intentions towards the German Empire. The writer concludes this letter with an admission that Germany has now no friends; the reason for this state of things, in his own words, arises from the fact that "All fear us and regard us as dangerous, because we are intelligent, active and morally the superior people. We are the most free people on earth, for we know how to obey." In an interview granted by Professor Ostwald to a representative of the *Dagen*, an important Stockholm newspaper, he is reported to have said that "Germany wishes to organize Europe." How this was to be done was explained by the Professor and his views are republished in this number of the series. This collection would not be complete without some record of Harden's views. Enlightenment on this subject is forthcoming from the pages of a recent issue of the *Zukunft*. He expresses himself in the following language:—"It is not against our wish that we have been drawn

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into this colossal adventure. It has not been imposed upon us by surprise. We have wished for it; and we ought to have wished for it. . . . Our strong arm will create a new law in Europe. It is Germany which strikes; when she has conquered new dominions by her genius, then will the priests of all the gods extol to the skies this blessed war. . . . Germany has not made this war to punish the blameworthy nor to liberate oppressed peoples and then to quieten her conscience in view of the fact that she has acted with disinterested magnanimity. She enters on the war by reason of an unshakable conviction that her works give her the right to more room in the world and to still wider outlets for her activity. . . . Spain and the Low Countries, France and England have seized and colonized great territorities, some of the most fertile in the world. The hour of Germany has now sounded, and she must assume her place as the directing power in this world."

Among the other professors quoted is V. Seyden. In an article which appeared in the *Frankfürter Zeitung* he shows the bitterness of his feeling against Great Britain in particular; according to him, "When peace is re-established, no self-respecting German will ever consent to stay in the same room as an Englishman. . . . We must, under a solemn oath, declare a vendetta against the English; we must never rest nor cease our preparations for another war, nor should we neglect the smallest effort until we have destroyed for all time even the minutest trace of English power. . . . The Germans are the elect of the earth; they will accomplish their destiny which is to govern the world and to direct the efforts of other nations in the interests of humanity." A French rendering of Lissauer's remarkable "Hymn of Hate" is appropriately included in this little volume; a perusal of these lines creates the impression that German hatred sounds equally bitter in verse as it does in prose, as exemplified by the extracts which precede the hymn. Among the military authors who have been laid under contribution by the editors of this number is Clausewitz; among his views to which prominence is given being the one in which he states: "Every idea of philanthropy in relation to war is a pernicious error; he who employs physical force to its fullest extent without sparing blood will always acquire preponderance over the enemy who does not so act."

From another extract a glimpse is obtained of the views held by von Schellendorf, who expresses himself in the following terms:—"The style of old Clausewitz is too soft . . . The next war will be atrocious! In the case of Germany and France, it is only a question of a duel to the death. . . . We will annex Denmark, Holland, Belgium, Switzerland, Livonia, Trieste and Venice, also Northern France from the Somme to the Loire. The foregoing programme, which we lay down without the smallest fear, has not been prepared by an idiot; the empire, referred to therein, which we desire to found will be no Utopia. We have from this time forth the means of realization at our hand."

Extracts from von Bernhardi's recent works have also been drawn upon; his opinions on war are, to-day, nearly as familiar to the peoples inhabiting this globe as are the words of their national anthems. The oft-quoted passage, "War is an instrument of progress, a regulator in

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the life of humanity, an indispensable factor of civilization, a creative power," reveals sufficiently the mind of von Bernhardi. The text of the somewhat remarkable Proclamation issued by the Kaiser to his Army of the East is given in full; therein William II. declares:—" I am the instrument of the Most High. Let the enemies of the German people perish! God demands their destruction, God Who by my mouth commands you to give effect to His wish."

Last autumn when the excesses committed by German troops in Belgium were uppermost in the public mind, there appeared in Germany manifestoes, one being an appeal to the civilized world signed by 93 intellectuals, as representatives of Science and Art in Germany, whilst another was a protest sent to Foreign Universities by 22 of the German Universities. These manifestoes are reprinted *in extenso* in this number, and it is quite evident that the signatories thereto cannot have had brought to their notice the letters of German officers, extracts from which are also contained in this number, wherein these officers bear testimony to the abominable behaviour of their men, who looted and destroyed on a wholesale scale. There exist in Germany, as is well known, groups and elements, by no means in sympathy with the doctrines which, in recent times, have obtained so strong a hold in their country. The dictates of fairness prompted that the views of this minority, who do not see eye to eye with their fellow countrymen, should have an equally wide circulation as the views of the other classes of the German nation whose public utterances have been laid under contribution in this little volume. Hence it is that there are to be found in this number extracts, in which opinions are expressed by no means in harmony with those forming the major portion of the contents of this little volume. Among the extracts containing the views of the minority are the protest raised in the *Reichstag* by Liebknecht in August last; the condemnation by German socialists of the crimes committed in Belgium and France by the Teuton hordes; a confession by Max Nordau that better treatment was meted out to Austrians and Germans in Paris than that meted out to the French in Berlin; and also a scathing denunciation of the dominant race in Germany by H. Heine, who says: " The Prussians? . . . nature has made wild beasts of them, and science has transformed them into evildoers."

The 41st number contains a collection of poetry inspired by the War.

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THE YEAR-BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY.

(The Wireless Press, Marconi House, Strand, W.C.).

THE publication of the 1915 issue of the *Year-Book of Wireless Telegraphy and Telephony* reminds us very forcibly of the immense progress that has been made in the extension and development of this form of communication during the last twelve months. The new volume of some 800 pages which lies before us serves not only as an admirable book of reference for all who have to do with the subject either in its commercial application or in the field of research; but also includes a complete historical *résumé* of the development of etheric wave telegraphy from its inception to the present day. All of us like to know something about the main factors which play their part in modern life, and some of us like to penetrate a little further into the mysteries; whilst others again already well informed, are anxious to keep abreast of the latest developments. All three classes will find in the *Year-Book of Wireless Telegraphy* exactly what they require.

Dealing with the main features of the book we come first to a carefully-compiled calendar succeeded by the exhaustive chronological account of the progress of wireless telegraphy above referred to. Here we have a chronicle in diary form showing at a glance what inventions and improvements were introduced in any particular year. This is followed by the full text of the International Radiotelegraphic Convention—a contribution of great value embodying the concerted policy of all the Governments in relation to wireless telegraphy. Incidentally it exemplifies the high importance officially attached to the new form of communication. The Safety of Life at Sea Convention stands next, the prominent part played therein by the various recommendations with regard to the employment of radiotelegraphy being specially notable. We then proceed to the text of the laws and regulations which are applied by the various countries to the control of wireless telegraphy both in relation to land and ship stations. A further extremely valuable feature, and one which should make a particular appeal to all interested in wireless telegraphy is the complete list of all ship and shore wireless stations together with their call signals and many other particulars. A copy of the *Year-Book of Wireless Telegraphy* will be very useful in every office, as it shows at a glance what ships are fitted with wireless apparatus, and the coast stations through which communication with them can be established. This list, together with the large and excellent map of the wireless stations of the world which is also provided, goes further than anything else we know to impress on the mind of the reader the world-wide field covered by wireless telegraphy. For ready reference the volume also includes an alphabetical

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list of call letters. In addition to the tabulated information which is a valuable feature of the book, our attention is drawn by a series of original articles. Mr. Archibald Hurd, the well-known naval critic of the *Daily Telegraph*, contributes an able article on "Wireless and War at Sea," and Colonel F. N. Maude describes the influence of wireless telegraphy on modern strategy.

Amongst the more technical articles we find a dissertation on "The Function of the Earth in Radiotelegraphy" from the pen of that eminent authority, Dr. J. A. Fleming. "Wireless Telephony," by Mr. H. J. Round, summarizes the progress that has been recently made. It is of particular interest to note that Mr. Round at Marconi House was able to receive telephone conversation by wireless from Berlin last year, although the success of experiments was not complete. When one considers that *wire telephony* with Berlin is a very recent achievement, the news that long-distance *wireless* telephonic communication has been in a measure achieved will come as a great surprise to many. Dr. W. H. Eccles, whose work in connection with wireless telegraphy is well known, contributes an article on Radiotelegraphic Research in 1914. Amongst further noteworthy articles we find important contributions on Wireless Long-Distance Service, Wireless Telegraphy and Meteorology, and International Time Signals.

Epitomized Biographical Notices of practically everyone of note in the world of wireless telegraphy, particularly of the various companies which are concerned in the development and exploitation of wireless telegraphy, and a long list of Patents and Patent Applications for the year 1914 all add to the volume as a book of reference, whilst the technical man and student will find the tables, formulæ and equations of the utmost value. Amateurs will welcome the Directory of Wireless Societies, and the learner will turn with pleasure to the reproduction of all the signs and signals of the Morse Code.

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NOTICE OF MAGAZINE.

RIVISTA DI ARTIGLIERIA E GENIO.

February, 1915.

THE SIEGE OF ADRIANOPLE.

In the victorious campaign that the four Balcanic States conducted against Turkey, fortress warfare held a prominent part, especially in the Turkish-Bulgarian theatre of war. Owing to the importance of the tactical rules that the various armies have rightly attributed to siege warfare, it naturally follows that the general staffs of the chiefs of these armies endeavour to study on the spot the operations of the sieges, and being unable to do so during the war, on the conclusion of the armistice they hastened to send special missions of officers to visit the strong place of Adrianople, around which the most important siege operations of this campaign had been developed.

It is interesting to consider the report of the Belgian Mission published in the *Bulletin de la Presse et de la Bibliographie Militaires*, as it is one of the most complete and trustworthy accounts of the operations of the attack and defence of Adrianople from the 22nd October, 1912, to the 26th March, 1913.

The work may be divided into the following parts :—

1st. The geographical and topographical conditions of the forts of Adrianople.

2nd. The conditions of this strong place and its defensive organizations.

3rd. Their functions in the theatre of operations.

4th. Operations of the attack and defence of the place.

5th. Observations and lessons.

1st. Geographical and Topographical Conditions.—Adrianople is about 40 km. from the Turkish-Bulgarian Frontier, and owing to its importance as a habitable centre is the second city of European Turkey, and a great agricultural emporium of Thrace. It is situated in the last great loop, open towards the east, that the Tungia makes near to its confluence with the Maritza and precisely on the south-west spur of the chain of heights that constitutes the dividing waters between the course of the Tungia and the lower course of the Maritza.

The village of Karagatch, recently built, at a little distance from Adrianople, is situated on the right of the Maritza, was inhabited by the European colony ; and was considered as a suburb of the city as it was connected by a metalled road, 3 km. in length, which crossed the Maritza and the Tungia by two masonry bridges.

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Adrianople lies in proximity to the great railway line Sofià—Constantinople which after passing along the Upper Maritza crosses the Arda by an iron bridge ; and passes to the south-east end of Karavatch where before the war was the small railway station of Adrianople. The town was inhabited by about 110,000 persons, half of whom were Turks and the other half Greeks, Jews, Bulgarians and Armenians. The roads of Adrianople are narrow and winding, the houses generally built of wood. In the immediate vicinity of the city there are large barracks, schools for the under-officers and an arsenal. The surroundings of the place are bare, without trees, without great lines of communication, and without cover, except the crests of the hills and some vineyards. A few small villages sparsely inhabited surround Adrianople ; and the houses of these are built of bricks, and with wooden or thatched roofs.

The ground during the winter is covered with marly mud which prevents the movement of carriages, of beasts of burden, and even of foot passengers. The fields all round the place are not ploughed, and the paths are impracticable during the bad season. There are a few metalled roads like that which runs to Kirkilepe to the south-east of Adrianople ; and another which from this town runs to the south-west towards Karagatch ; and also the road which on the left bank of the Upper Maritza bears towards the locality called Mustafà-pascià, at a little distance from the river and with a road raised about 10 m. from the surface of the water which is not covered during the floods.

2nd. Conditions of the Place, and its Organization for Defence.—In 1908 after the revolution of the young Turks, the new Ottoman Government had transformed Adrianople into a modern fortress by placing it in a state to cover, together with the two forts of Kirkilepe, the mobilization of the Turkish Army, and to bar the way to Constantinople to an eventual Bulgarian invasion of Thrace by the Maritza and Tungia Valleys.

In fact, the progress of transformation, designed by German military engineers in the service of Turkey, was only carried out in the North-West Sector, which the German Field Marshal, von der Goltz, had considered the most likely for attack, when in 1909, he directed the first great Turkish manœuvres. So that at the commencement of hostilities, 18th October, 1912, the place was found almost in the same condition as that of 1877 ; that is with a simple ceinture of old works constructed by means of field and mixed fortifications, and placed at a small distance from the inhabited nucleus. The place was now encircled with barbed-wire entanglements. The intervals between the forts were not generally speaking more than 1,000 m.

In the same North-West Sector there was not even a single permanent work that could be called modern ; so that the new forts were in reality simple rectilineal trenches for infantry, without proper flanking defences, protected only on the front and flanks by lines of barbed wire.

Between the forts there were several exposed batteries some of which however were of armoured cement ; and the latter were armed with old pattern guns brought from old forts which had been disarmed.

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The several groups of forts armed with artillery were as follows :—

Group of Karakustaria, 54 guns.	A new fort : L'Yazu-Tepè. An incomplete fort to the west of the former. Two batteries of 6 guns of 15 cm. Two batteries of 6 guns of 12 cm. Five batteries of 6 guns of 8·7 cm.
Kurutchesme Group, 30 guns.	Two batteries of 6 guns of 15 cm. One battery of 6 guns of 8·7 cm. One battery of 6 howitzers of 15 cm. One battery of 6 mortars of 21 cm. Several entrenchments.
Gheitantaria Group, 24 guns.	An old entrenched fort : Karakus Tabia, with barbed-wire entanglements. Two batteries of 3 guns of 10·5 cm. Three batteries of 6 guns of 8·7 cm.
Kazan-Tepè Group, 39 guns.	Two new forts : Kazan-Tepè and Kazan-Kepra. One battery of 6 guns of 15 cm. One battery of 6 guns of 10·5 cm. One battery of 3 guns of 10·5 cm. Four batteries of 6 guns of 8·7 cm.
Kemer Bachiuk Group, 54 guns.	Two old forts : Bachiuk and Kemer. One battery of 6 guns of 15 cm. One battery of 6 guns of 10·5 cm. Six batteries of 6 guns of 8·7 cm. One battery of 6 mortars of 15 cm.

All the work of this sector except those of Uchtepeliè and Kadikeu were connected with the town of Adrianople by permanent railways, Decanville, Kazan-Tepè, Kemer-Bachiuk and Handerluk, and were connected with the interior of the fortress by ordinary metalled roads.

North-East Sector.—On the principal lines for about 16 km. there were arranged in steps nine forts and several batteries. Fronting towards the north there were in batteries and in the intervals of the forts Kaialuck-Tabia, Nuovo Tach-Tabia and Aivas-Babia :—

One battery of 6 guns of 15 cm.
Two batteries of 4 guns of 15 cm.
One battery of 6 guns of 12 cm.
One battery of 6 guns of 8·7 cm.

On the left on the Eastern Front there were in batteries in the intervals and in the vicinity of six forts 108 guns and mortars, viz. :—

Four batteries of 6 guns of 15 cm.
One battery of 6 guns of 10·5 cm.
Eleven batteries of 6 guns of 8·7 cm.
Two batteries of 6 mortars of 15 cm.

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In rear of the before-mentioned principal lines of defence there were two old forts near to the Tungia, and behind the extremity on the other side of the principal lines towards the east there was the old Fort Kaik. In front of the salient Aivas-Baba there was the advanced group of Maslach, consisting of new modern but incomplete works, and three batteries each for 6 guns of 8·7 cm.

South-West Sector.—The principal lines of defence of about 10 km. in this sector comprise three groups of works :—

Bosnakeui Group, 6 guns.	One old fort (Bosnakeui). One battery of 6 guns of 15 cm.
Suiskli Groups, 24 guns.	An old fort (Domerdegh). Two batteries of 6 guns of 15 cm. Two batteries of 6 guns of 8·7 cm.
Karagatch Group, 30 guns.	Two old forts (Karagatch and Marach). Two batteries of 6 guns of 15 cm. Three batteries of 6 guns of 8·7 cm.

In these sectors there are no advanced works, but there is a line of external positions, as in the other sectors, about 6 km. distant from the principal lines. The Turks had also established advanced posts on the Hill Kastal Tepè.

West Sector.—The principal lines of defence at only 6 km. consist of trenches, excavated in front of the village of Marach, on the hill Papas Tepè. The lines of external positions protected by the right bank of the Upper Maritza and the left of the Arda, form as it were an arc of a circle with the centre at the confluence of these two rivers. Altogether, then, extending for about 50 km. of the principal lines of defence, the place opposes to the attack about 419 guns, placed in batteries on the lines of the old forts which had been entirely disarmed, except the new Tach-Tabia on the North-East Sector, and utilized either as protective places for the infantry, or as depôts for projectiles or other artillery material. The general reserve of artillery contained 138 guns.

As defended from outside the place presented to the attack the following defensive dispositions—One line of external positions consisting of trenches ; one principal line of defence, surrounded by formidable entanglements of barbed wire, and comprising places of protection for infantry, old and new forts, in connection with the trenches and field batteries. The barbed-wire entanglements of a depth of 8 to 10 metres distant from 50 to 100 metres from the lines of the work of the principal zone of defence. The field batteries generally constructed on the crest, were actually visible. Those of medium calibre which were situated on the lines of the old forts, presented easy targets to the attacking artillery.

Outside and behind the forts there were constructed recovering places of masonry for the troops assigned to the principal lines of defence ; and these recovering places were connected with the forts by trenches.

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March, 1915.

THE FORTIFICATIONS AND THE STRATEGICAL IMPORTANCE OF THE PANAMA CANAL.

The republic of Panama has an area nearly equal to that of Scotland. The independence of the republic is guaranteed by the United States who assume the responsibility of its military defence. The country is sparsely populated and a great part is covered with forests.

The entire zone of the canal, a strip that extends for 8 km. on the two sides and for its complete length is prolonged for 5 km. into the sea at the two extremities, and is in the absolute possession of the United States. The two towns of Colon and Panama are not included in the zone. The Bay of Limon in the Caribbean Sea is partially closed by a dyke extending for about 3·2 km. from the point Toro towards the north-east.

The canal properly called commences in the bay, where it has a direction from north to south, and requires continually for its whole course dredges for the removal of the sand; and proceeds after traversing the bay, for 4·8 km. in a low marshy zone, ending at Gatun where there is the great plant for the opening and closing of the locks. These are double. Each is subdivided into three compartments which are of such dimensions that each can contain one of the largest mercantile or war ships. In the locks, where the water can be raised to the level of the Bay of Limon and that of the Gatun Lake—the ships can follow one another at an hour's interval; so that the locks being double 48 ships can pass in 24 hours. The whole course of the canal is illuminated at night for 15 hours.

Passing the locks at Gatun the ships traverse at a moderate speed the lake of the same name for 36 km., and then for about 13 km. the famous cutting of Culebra. This is the narrowest part of the canal which here is not more than 90 m. in width; so that everywhere it allows for the passing of two ships at the same time. In the Culebra Cutting the canal lies at 12 m. below the level of the sea. The hydraulic plant at Gatun serves to regulate the level of the water of the lake in such a manner that in dry seasons the canal, in the stretch of the Culebra Cutting, has not less than 12·3 m. of water; which is sufficient for secure navigation. At the southern extremity of the Culebra Cutting, near to Pedro Miguel, a second system of locks serves to lower the ships to the level of the small lake of Miraflores, at the extreme end of which there is a double lock of the same name to carry the ships to the lower level of the last stretch of the canal, which excavated in a marshy zone, leads to the Gulf of Panama. The total length of the canal, including the two stretches in the sea is about 81 km.; excluding these stretches only 64 km. The canal from its entry at the Pacific, in the Gulf of Panama, is protected by a dyke 3·5 km. in length which joins the island of Naos on *terra firma* and is prolonged to the other two islands of Perico and Flamenco.

The Defences of the Canal.—The president of the commission charged with the study of the canal, Colonel Goethals, had advocated the necessity of permanently stationing a corps of 20,000 or 25,000 men, in the conviction that. with such a force, and with the assistance of the fortifications, a resistance could be made similar to that of Port Arthur. But under the peculiar conditions of the United States the troops des-

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tined in peace times for the defence of the canal were reduced to 8,300 men, of which number 1,300 were coast artillery. The fortifications are designed to oppose attacks either by sea or land. There are also commodious barracks at Culebra and Miraflores for the troops which comprise 12 coast companies, 4 infantry regiments, 1 group of mountain artillery, 1 squadron of cavalry, 1 company of engineers, 1 company of signallers, 1 sanitary company. These troops are destined for the defence of the locks at the two extremities of the canal.

Gatun and Miraflores are connected by a railway (58 km.). There are also some excellent paved roads, and there are boats on the Gatun Lake for the supplies required by the troops. The forts at the mouth of the canal in the Pacific are arranged as follows :—Near Balboa on dry ground the Fort Amador with 2 batteries, each of 4 guns of 15 cm. In the group of the three islands, Naos, Perico, Flamenco (connected with one another and with the mainland by an embankment on which a railway will probably be constructed), there is Fort Grant which contains 6 batteries completely armed with guns of 40·6 cm , at Flamenco, 12 mortars of 30·5 cm., 2 guns of 15 cm. and 8 guns of 12 cm. At about 11 km. south of this island group, is situated the island Taboga for which no fortification has been projected. It was considered by the commission of defence for the canal, General Wedver, that the fire from the mortars at Fort Grant could reach this island. The objection has been raised by some that the island Taboga being undefended by forts might without difficulty become a place of refuge for an enemy's ships. So that there is a probability that in the future the island may be fortified. The locks at Miraflores distant 12 k.m. from Flamenco are not visible by ships from the Gulf of Panama, and are protected towards the south by a hill.

At the mouth of the canal in the Atlantic the defensive works are organised as follows :—On the island Margarita low down on the beach there is Fort Randulph ; on the slight elevation at point Toro there is Fort Sherman. These two works are the principal ones destined for the mouth of the canal in the Caribbean Sea. Fort Randulph consists of 3 batteries armed with 8 mortars of 30·5 cm., 2 guns of 35·6 cm. and 8 guns of 12 cm. Fort Sherman has the same armament distributed in 4 batteries. Both are connected with the Panama Railway. In addition to these principal works at the point Manzanillo near Colon there is Fort Lesseps armed with 2 guns of 15 cm. The principal works, both on the Atlantic and the Pacific, are defended by mine-fields. The zone of the fortifications is not subject to frequent mists, so that it is not likely that the enemy's ships except submarines would be able to pass unobserved. Submarines for defensive purposes are stationed at both ends of the canal. The locks at Gatun are visible by ships from the Caribbean Sea 11 km. from the Toro Point. One means of rendering the canal impracticable would be the damaging of the plant that serves to regulate the water in the locks. The destruction of the cemented embankment would require not less than two days ; but should it succeed the losses would be immense ; and the passage through the canal would be impeded for several months. To accomplish this the banks of Rhio Chagres in the middle of the dyke near Gatun would be an important object of attack. All the zone of the canal

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considered as a military zone, and no centres for inhabitants are permitted to be established within it. It is believed that the rank vegetation of this moist and tropical region would efface the traces of footpaths and mule tracks and would create such a growth of trees and bushes that for any detachment of troops to advance through it, the way would have to be opened, step by step, with the hatchet. Malaria is combated with all special precautions of mosquito nets, and good water; so that the annual mortality is now reduced to 11 per cent., while at an earlier period it was 35 per cent. The healthy zone does not extend far; so that an enemy's troops who might venture into the contiguous regions would suffer great losses from malaria and yellow fever.

Maritime Plant.—In the zone of the canal the following plant is furnished by the maritime department. At Caimito in the middle of the Isthmus of Panama there is a powerful wireless telegraph station, with a radius of 4,000 km., which can communicate not only with Washington, but also with San Francisco, Buenos Ayres, Valdivia and S. Vincenzo on the Cape Verde Islands. And it may be noted that no nation except the United States can establish wireless telegraphy in the whole of the republic of Panama.

At Balboa, protected by high hills, there is a great careening basin, near to which there are buildings and offices for effecting repairs. At Colon and Balboa there are also very large storehouses for coal of capacity of 290,000 tons and 160,000 tons respectively. There are also two depôts for petrol at the two extremities of the canal; and along the whole length of the canal there is a tube for the distribution of oil to the ships. There are now constructed depôts for provisions and refrigerators, and there are barracks for from 500 to 1,200 men.

Strategical Importance of the Canal.—The conditions of the Federal States on the Pacific coasts are such that naval forces taking refuge in their ports would not be sufficiently secure and would have to be reinforced by ships taken from the ports in the Atlantic. The strategical scope of the Panama Canal is that of allowing the United States in case of need to send ships from the Atlantic to the Pacific, by a route of 8,000 miles shorter than that formerly followed by the Straits of Magellan, and *vice versâ* to draw ships as reinforcements from the Pacific to the Atlantic. The duties of the Pacific Fleet are essentially the following:—

(*a*). The defence of the Californian States, of Oregon, Washington, and Alaska, against an invasion on the part of Japan.

(*b*). Protection of the Philippine Islands.

(*c*). Direct action to assure to the United States the possibility of exercising influence on the future development of China.

(*d*). Sustaining the Monro policy on the American-Latin coast, Mexico and Chili.

The distance from New York to San Francisco passing round Cape Horn is 13,700 miles or rather more than from Petrograd to Vladivostok by the Suez Canal, by the Panama Canal it is reduced to 5,300 miles. This also improves the situation of the United States indirectly insomuch as the migratory current from Europe tends more than in the past towards the Pacific, and would render more difficult the penetration of the yellow races into the Western States.

E. T. THACKERAY.

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CONSTRUCTION OF BRIDGES IN THE FIELD.

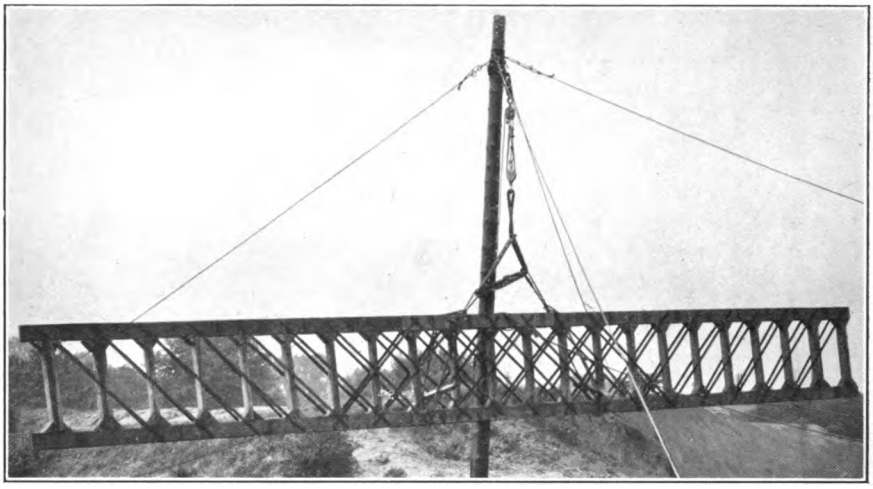
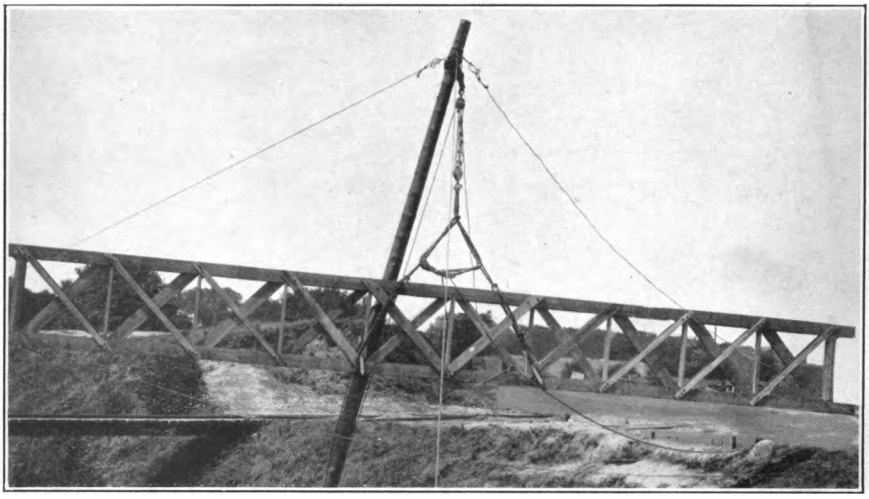


Photo 1.



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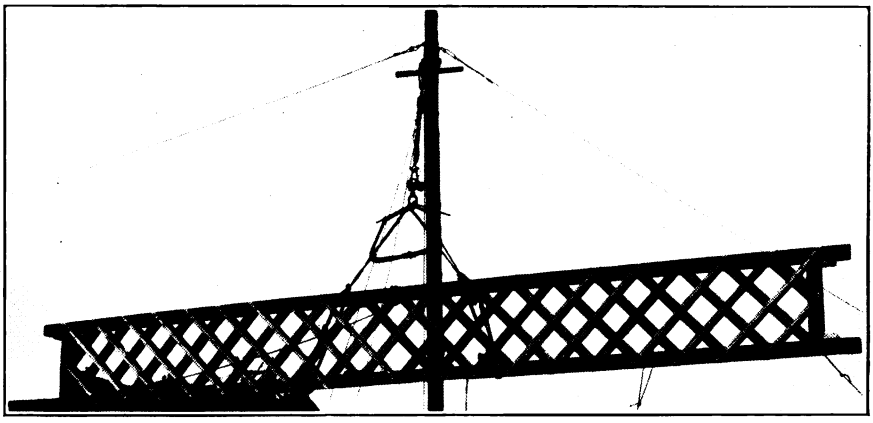

Photo 3.

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CONSTRUCTION OF BRIDGES IN THE FIELD TO TAKE HEAVY MOTOR TRANSPORT.

By CAPT. G. C. GOWLLAND, R.E.

IN the following article two forms of girder are suggested. They are designed so that four girders would be required to carry the heaviest form of motor traffic over a 50-ft. gap.

The type of lorry chosen is that having 17,700 lbs. on the hind axle, 7,100 lbs. on the fore axle, distance between axles 13 ft., distance between hind axle of one lorry and fore axle of the one behind it being 10 ft.

With the exception of the fastenings the girders are made entirely of wood. To arrive at the stresses in the members of the girders it is only necessary to calculate by the method of sections the stresses in one simple N girder (shown in *Fig.* 2) and from this it is easy to arrive at the stresses in the members of the more complex girders.

Fig. 1 shows the loading under a train of lorries when the maximum number of heaviest axle loads are on the bridge. Under this loading one of the heavy axles is near the centre. It is obvious therefore that the greatest bending moment will occur when the central heavy axle load (marked A, *Fig.* 1) is somewhere near the centre.

The actual M_{ff} occurs when the load A is ·2 ft. to the left of the centre and is under the load A. For all practical purposes we can consider the M_{ff} to occur when the load A is at the centre of the bridge and when the bridge is loaded as in *Fig.* 1. The M_{ff} under this loading is 352,500 foot-lbs. Reduce this to equivalent dead load by multiplying by $\frac{3}{2}$. Then the M_{ff} due to the equivalent dead load is 528,750 foot-lbs. Let W lbs. be an evenly distributed load over the bridge that produces an M_{ff} of 528,750 foot-lbs.

Then $$\frac{WL}{8}=528750.$$

$\therefore$ $$W=84{,}600 \text{ lbs.}$$

Therefore an evenly distributed load of 84,600 lbs. placed on one bridge will give a bending moment equal to that produced by a train of lorries placed on the bridge in such a way as to produce the greatest bending moment in the bridge.

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Suppose we decide to use eight N girders to carry the lorries. Each girder having panels 5 ft. × 5 ft. Then each N girder takes $\frac{84600}{8}$ lbs. = 10,575 lbs.

Therefore each 5-ft. panel takes 1057.5 lbs. say ½ ton.

Suppose the dead weight of each girder with its superstructure to be 1¼ tons; then the loading of one of our eight girders will be as in *Fig.* 2.

If the lorries are run on the top boom the maximum stresses caused by a train of lorries rolling over the bridge are as written down in *Fig.* 2. These stresses are worked out by the method of sections. An example of this was fully worked out in the July issue of the *R.E. Journal.*

Suppose the diagonals of our N girders sloped upwards from left to right as in *Fig.* 3 instead of from right to left as in *Fig.* 2; then eight girders stressed as in *Fig.* 3 would carry the load.

Suppose we take one girder stressed as in *Fig.* 2 and one stressed as in *Fig.* 3, and place one behind the other so that all the members except the diagonals coincide and then firmly lash them together; we then obtain a girder stressed as in *Fig.* 4 and of the form shown in *Fig.* 4.

This girder (*Fig.* 4) is twice as strong as either of the N girders and therefore four girders stressed as in *Fig.* 4 will carry one load instead of eight N girders. The stresses in *Fig.* 4 are obtained by adding together the stresses in the bars when they coincide. The stresses in the verticals, except the end two, vanish but verticals are put in capable of transferring half the panel point loads from the top boom to the bottom boom. The stress in the end vertical equals 7,000 lbs. plus the load on the panel point above it, *i.e.* 7,700 lbs.

Therefore the stress in the end vertical is 7,700 lbs. compression.

It is obviously not practical to make up a number of N girders and lash them together, and it is also impractical to use eight N girders in a bridge of this sort to carry a single line of traffic. The superimposing of girders is merely a quick method of getting at the stresses in structures built up of one or more simple types.

Fig. 4 therefore gives us the maximum stresses that can come on a double Warren if four girders are used to carry a train of lorries over a 50-ft. gap. The members in the middle panels can be either in compression or tension.

This reversal of stress is caused by the different forms of eccentric loading that a line of heavy traffic can bring on the bridge as the head comes on, or the tail of such a train of loads leaves the bridge.

We therefore have to construct a girder capable of withstanding the various stresses shown in *Fig.* 4.

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Booms.—The maximum stress is 34,300 lbs. in compression or tension.

Suppose 9-in. × 3-in. timber (fir) is available and that we propose to joint our booms with $\frac{3}{4}$-in. round iron drift bolts. One 9-in. × 3-in. bored for a $\frac{3}{4}$-in. drift bolt has an available section of $8\frac{1}{4}$ in. × 3 in. = 24·75 square inches. Using one 9-in. × 3-in. in our booms we see that the timber will be stressed up to

$$\frac{34300}{24{\cdot}75} \text{ lbs. per sq. inch}$$
$$= 1{,}388 \text{ lbs. per sq. inch.}$$

This is quite safe as far as the tension boom is concerned as fir in tension may be safely stressed up to 1,600 lbs. per square inch. This allows in ordinary cases a factor of safety of about 5.

A continuous cover plate of 9 in. × 3 in. must be used in forming our joints. Thus the compression boom will be quite safe, as our available section in compression will be now 54 square inches.

Jointing of Booms.—$\frac{3}{4}$-in. round iron drift bolts are used. One bolt passing through a 3-in. fir plank will safely take a pull of $\frac{3}{4} \times 3 \times 1200 = 2{,}700$ lbs.

Therefore the number of drift bolts on each side of every joint in the boom will be

$$\frac{31450}{2700} = 12 \text{ bolts approx.}$$

Therefore the bolts will be arranged 12 on each side of every joint.

The bolts must be staggered. That is no two bolts must be in the same vertical plane or the section of the booms will be reduced. The component members of the booms must be arranged so that there are no joints near the centre of the bridge where the boom stresses are maximum.

Ties.—Maximum tension in a tie is 9,000 lbs.

Therefore using two ties one on each side of the boom we see that each tie has to take 4,500 lbs.

One 4-in. × 1-in. fir batten takes in tension when bored for a $\frac{5}{8}$-in. bolt 5,400 lbs.

Therefore if we use two 4-in. × 1-in. battens one on each side of the boom we shall be safe.

Fastening of the Ties.—One $\frac{5}{8}$-in. coach screw takes a pull of 1,600 lbs.

Therefore if we use three $\frac{5}{8}$-in. coach screws at the end of each tie we shall be safe. This is not strictly true in this case as a $\frac{5}{8}$-in. coach screw passing through a 1-in. batten will fail by bearing into the batten before it pulls out of the boom, or it may slot out at the end of the batten. To prevent the $\frac{5}{8}$-in. coach screw bearing into the

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tie, the tie should be 2 in. thick at least, or else more $\frac{5}{8}$-in. screws should be used.

In this experimental girder however each $\frac{5}{8}$-in. screw was supposed to take its full 1,600-lb. tension even when passing through a 1-in. batten. Large washers were used under the heads of the coach screws and the friction between the tie and the boom relied on to some extent. This is not really a good plan and it would be better to increase the thickness of the ties though this will increase the weight of the girder.

The tie joint is shown in *Fig.* 7. The same sized ties will do for the first three ties from each end. The fourth tie from each end is subject to compression under certain conditions of loading. The maximum compression is 361 lbs.

Therefore each tie takes 180-lb. compression. Use therefore two 7-in. × 1-in. ties fastened by one $\frac{5}{8}$-in. screw. This joint is shown in *Fig.* 9. The centre ties are subjected to a compression of 1,410 lbs. and a tension of 2,600 lbs.

Therefore each tie takes 1,300-lb. tension or 705-lb. compression.

From Table of Struts, *Manual of Military Engineering*, Part IIIA., a 7-in. × 2-in. strut 6 ft. long takes 30 cwt. in compression.

Two 7-in. × 2-in. will therefore be safe for our ties in the centre.

The 7-in. × 2-in. ties will be halved on the booms so that the shoulder so cut will take the compression. The part of the 7-in. × 2-in. overlapping the boom is fixed with $\frac{5}{8}$-in. coach screws to take the 1,300-lb. tension.

The joint is arranged as in *Fig.* 13.

The compression members can be looked out in the curves for struts, *Manual of Military Engineering*, Part IIIA., and are as shown in the drawing of the completed girder. Each strut has an inch tenon cut at each end. This inch tenon is slipped between the two members of the boom. The shoulders at the haunch of the tenon take up the compression and $\frac{5}{8}$-in. coach screws passing through the boom and the tenon keep the strut in position and take any tension that comes on the compression members.

The details of the compression joints are shown in *Figs.* 7 to 13. The verticals take 1,400-lb. compression and 7-in. × 2-in. timber are used for them.

The completed girder is shown on *Fig.* 5. A single girder constructed as described was made up and tested.

The load put on the girder was as in *Fig.* A. This was supposed to represent a traction engine having axle loads of 11 tons behind and 5 tons in front. The heavy axle of one engine being on the centre of the bridge and the fore axle of another just coming on. As four girders are used the actual live loads produced by the traction engine on a single girder would be $1\frac{1}{4}$ and $2\frac{3}{4}$ tons fore and hind axles respectively.

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Therefore the test load allowed ample margin for live load.

Under the loading shown in *Fig.* A the girder deflected 1½ in. and when the load was taken off the girder recovered itself completely there being no permanent measurable deflection. The dead weight of this girder is 1 ton, but with heavy decking, etc., the dead load of 2½ tons assumed for calculation is not far out.

A different form of girder made up of four Warren girders can be evolved from the girder shown in *Fig.* 4. This girder (*Fig.* 4) is made up of two Warren girders having verticals. Suppose we do away with the verticals of the girder (*Fig.* 4) by resolving the verticals along the two members that meet the verticals at the top boom, and then split the girder (*Fig.* 4) into two girders shown in *Fig.* 16 and *Fig.* 17. Then four girders as in *Fig.* 17 together with four girders as in *Fig.* 16 will carry the same load as four girders as in *Fig.* 4.

Suppose now we draw two girders as shown in *Fig.* 18 and *Fig.* 19. We can get the stresses in these girders by a process of interpolation from the girders *Figs.* 16 and 17. The stresses in the sloping bars decrease as they approach the centre.

We shall be quite accurate enough if we assume the bar EF, *Fig.* 18, is the mean of the values of the bars AB, CD. The other bars in *Figs.* 18 and 19 are calculated in this way and the values thus obtained written down against the bars. The only two bars we do not know about are the bars EE′, *Fig.* 18, and the bar SS′, *Fig.* 19. But knowing that the stresses in the bars increase in arithmetical progression we can write down the stress in these bars with fair accuracy.

Suppose we fuze together the four girders *Fig.* 16, *Fig.* 17, *Fig.* 18, *Fig.* 19, we obtain a girder twice as strong as the girder *Fig.* 4.

Halving the stresses in our composite girder we obtain a girder stressed as *Fig.* 20 which is as strong as the girder *Fig.* 4.

As the span, the weights to be carried, the number of girders, and their depth is the same in *Fig.* 20 as in *Fig.* 4 the maximum stresses in the booms will be the same.

The end vertical in the double lattice girder *Fig.* 20 will be in greater compression than the end vertical in *Fig.* 4; further the end vertical in *Fig.* 20 is under bending stress.

To carry a train of lorries over the 50-ft. gap we therefore have to construct a girder capable of taking the stresses shown in *Fig.* 20. The calculations for these members and their joints need not be gone into as they are worked out in the same way as in the previous case.

The completed girder with details of joints is shown in *Fig.* 21. This girder was tested with a 6½-ton central load. The deflection was 1½ in. and there was no permanent deflection measurable when the load was taken off. The weight of the girder is 1 ton.

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Large washers under the coach screws are useful in preventing the fibres being cut. As the booms are not bolted together it is advisable to bind them every few feet with hoop iron. This is more necessary in the compression than the tension boom as under compression the boom members tend to spring apart. The connecting bolts have no heads and the only thing that prevents the boom opening is the friction on the drift bolts and the coach screws. The method of putting in the drift bolts consisted in boring a hole $\frac{1}{8}$-in. diameter less than the round iron and then driving up the drift bolts. Any sort of round or square iron taken from railings, etc., can be used.

Three photographs of girders are given:—

Photo 1 shows a Linville girder made with steel ties all of which are designed to take tension, there being no compression diagonals in this girder.

Photo 2 shows a girder made up of two Warren girders.

Photo 3 shows a girder made up of four Warren girders.

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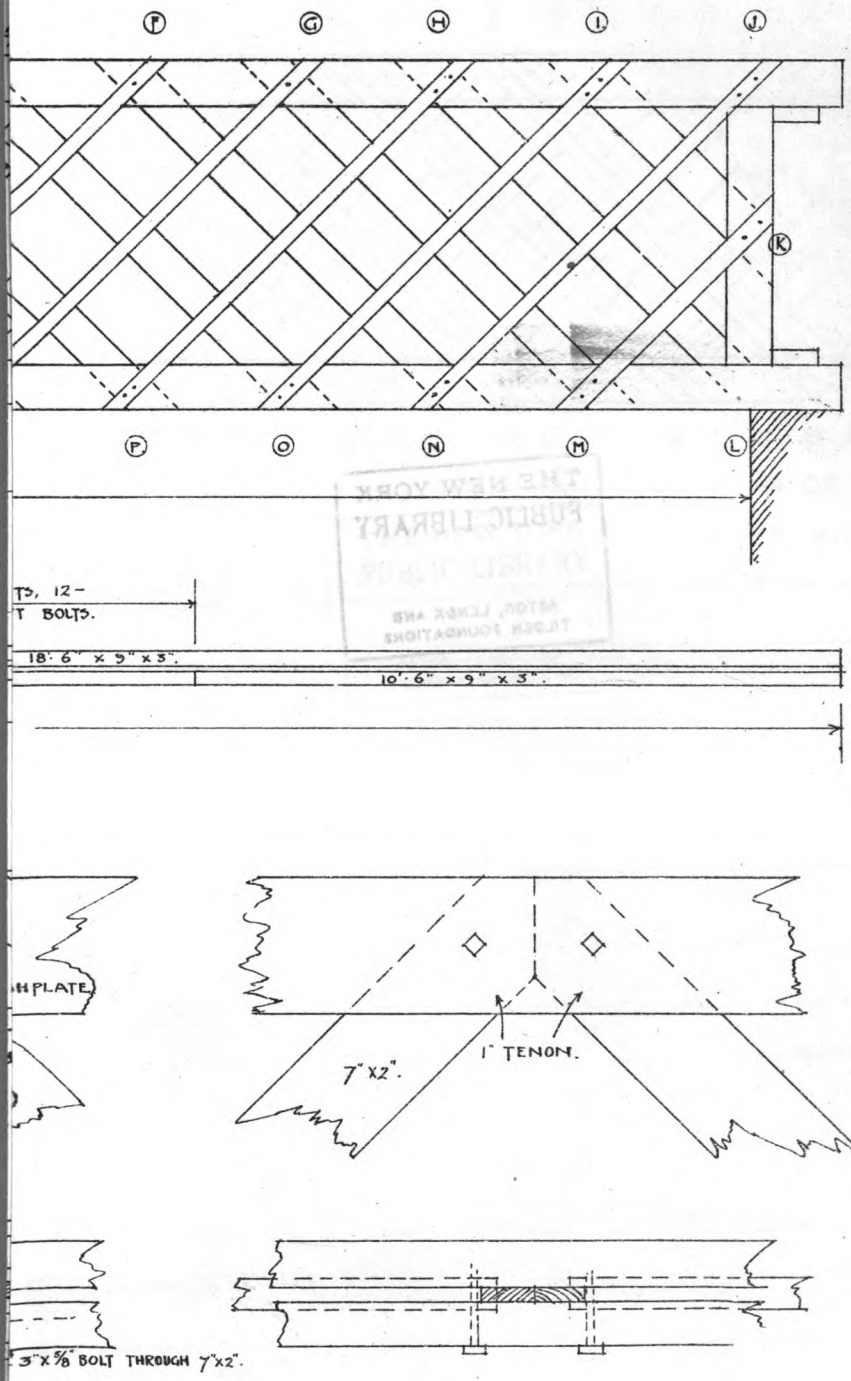

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Y GIRDERS

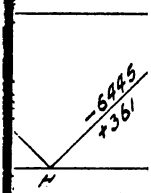

FIG 16

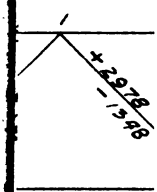

FIG 17

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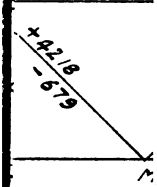

FIG 18

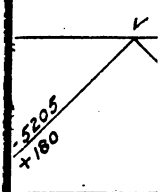

FIG 19

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AN ACCESSORY TO THE BRIDGING EQUIPMENT.

By LIEUT. G. LE Q. MARTEL, R.E.

Reproduced from the "R.E. Journal" of March, 1914, by request.

A FIELD COMPANY often has to bridge a small river or ditch from 15 to 20 ft. wide, and with the present bridging equipment, if the river is even $15\frac{1}{2}$ ft. wide, a support has to be used in the centre, as the baulks are only 15 ft. long. The following is a short account of a collar that has been made for joining baulks side by side, so as to avoid having to use a support for spans just over 15 ft., and from the calculations shown below, it will be seen that by using five pairs of baulks in this way, it is possible to bridge a 19-ft. gap for field guns or infantry in fours. This is also very useful when the last span in a bridge is just over 15 ft.; for instance, if a river is 48 ft. wide, it could be bridged by a Field Company by using two pontoons, and the last span could then be crossed with baulks joined up for an 18-ft. span; this would save using a trestle (which generally causes some little delay), and the bridge built in this way would be just as strong as if the trestle had been used.

Fig. 2 shows, in plan, two plain baulks connected up for a 19-ft. span. *Figs.* 1 and 3 show details of the joint. The parts required

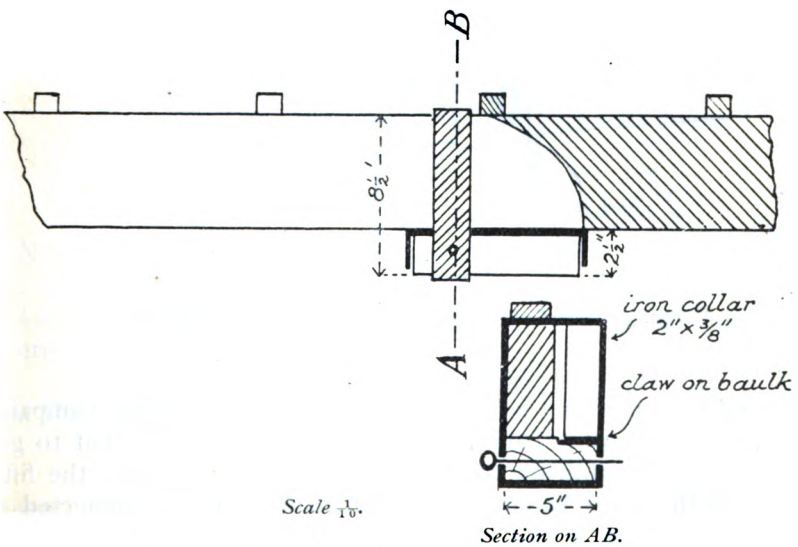

FIG. 1.—*Elevation showing joint of two button baulks.*

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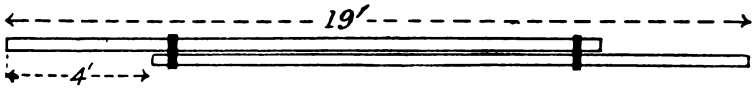
are an iron collar $8\frac{1}{2}$ in. high, and 5 in. wide, and a block of wood 5 in. wide and $2\frac{1}{2}$ in. thick. To connect up, two button baulks are first taken and placed as in *Fig.* 2. The most usual distance required is 19 ft., as this will take guns, but one of the baulks can be slid in or out to any required distance so long as it is an exact number of feet, so as to bring the buttons of one baulk opposite the buttons on the other. The iron collar is then slipped over one end of one baulk and pushed beyond the claws of the second baulk; the wood block is placed between the claws, and the iron collar slipped back to a position as shown in *Fig.* 1. The other end is treated in the same



Scale, 1" = 5'.

FIG. 2.—*Plan of two plain baulks joined for a* 19' *span.*

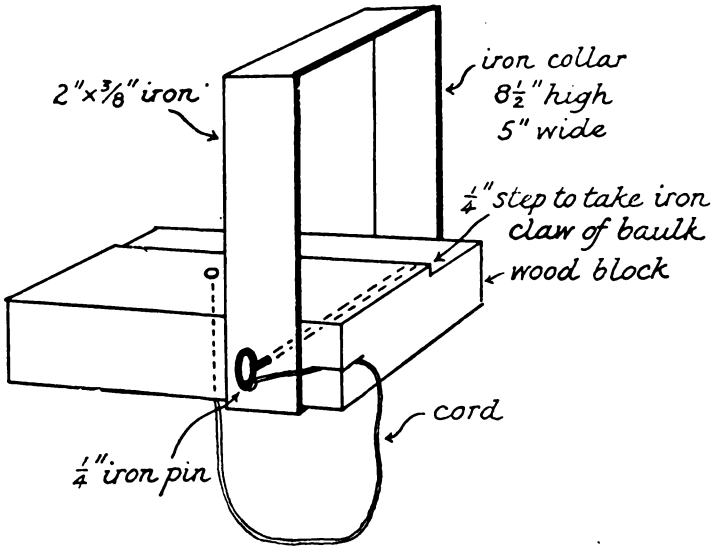


FIG. 3.—*Sketch showing parts required for joining baulks.*

way, and we have then a baulk 19 ft. long, and as strong, comparatively, as a single 15-ft. baulk. It is useful to remember that to get 19 ft., the first button on one baulk must be put opposite the fifth button on the other baulk. The plain baulks can be connected in the same way, but, in this case, the block can be put straight in its place, and the iron collar slipped over from the end, as there are no

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buttons to foul the collar. The wood block cannot slip out because it is held by the claws at the end of the baulk, but the iron collar might slip, and a pin of $\frac{1}{4}$-in. iron is therefore used, which passes through the collar and block. This pin is attached to the block by a piece of strong cord. In order to prevent the pin from falling out of its place, a saw cut is made as in *Fig.* 3 on the corner of the block, and when the pin has been pushed home the cord is forced into the cut, thus holding the pin. This avoids having to use a small contrivance, such as a hinged end to the pin or some similar arrangement, which would possibly jam or break. A $\frac{1}{4}$-in. step has to be cut on one side of the wood block to allow room for the iron claw on the end of the baulk. After a little practice a set of baulks can be connected up for a 19-ft. span in a few minutes.

Calculations.—Take first of all the ordinary bridging baulk 15 ft. long. Five of these will take infantry in fours crowded at a check, *i.e.* each baulk takes a distributed equivalent dead load of $\frac{5}{4}$ cwt. per foot-run.

Hence the M_{ff}

$$=\frac{wl^2}{8}=35 \text{ ft.-cwt.}$$

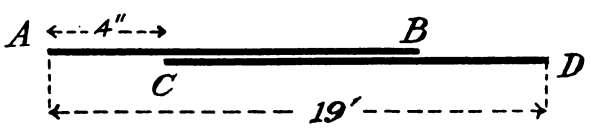
and the M.R.

$$=\tfrac{1}{6}rbd^2=\tfrac{1}{6}r\times\tfrac{3}{12}\times(\tfrac{6}{12})^2 \text{ ft.-units}=\frac{r}{96}.$$

Equating these

$$r=96\times 35 \text{ cwt. per square foot.}$$

This comes to 24 cwt. per square inch, which can therefore be taken as a safe working load.



Now take a pair of baulks extended to 19 ft.

In the above figure AB represents one baulk and CD the other.

Taking the load, as before, of $\frac{5}{4}$ cwt. per foot-run the B.M. at the centre is

$$\tfrac{5}{4}\times\tfrac{1}{8}\times(19)^2=56 \text{ ft.-cwt.}$$

and the M.R. is

$$r\times\tfrac{1}{6}\times\tfrac{6}{12}\times(\tfrac{6}{12})^2=\frac{r}{48} \text{ ft.-units ;}$$

hence

$$r=\frac{48\times 56}{144} \text{ cwt. per square inch}=\textit{19 cwt.} \text{ which is quite safe.}$$

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Now take the point C.

The B.M. at this point is

$$\frac{5 \times 19}{8} \times 4 - \tfrac{5}{4} \times 4 \times 2 = 37{\cdot}5 \textit{ ft.-cwt.}$$

And the section of the beam at this point is $2\frac{3}{4}$ in. × 6 in.;

hence M.R. $= \frac{1}{6} rbd^2$

$$= \frac{11r}{1152};$$

hence $r = \frac{1152 \times 37{\cdot}5}{11 \times 144}$ cwt. per square inch

$= 27$ *cwt.* per square inch.

This is just slightly more than the working stress for the ordinary 15-ft. bay with single baulks, but it must be remembered that infantry will very seldom be crowded up sufficiently close on a 19-ft. bay to give a distributed load of 5 cwt. per foot-run.

A bridge made with double baulks extended to 19 ft. was tested with infantry crowded in fours, both marking time and standing still, and stood the test satisfactorily. Field guns were also taken over the bridge, but these bring a considerably smaller load on to a 19-ft. span than infantry in fours crowded.

The strain in the iron collar is quite small and a large factor of safety is provided by using 2-in. × $\frac{3}{8}$-in. iron.

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*THE STRATEGICAL RELATIONS OF FRANCE AND GERMANY DURING THE YEARS IMMEDIATELY PRECEDING THE PRESENT WAR.**

Being an Abridgment of a Study of the Situation by General Maitrot.

INTRODUCTION.

THE third edition of a little volume containing a collection of seven essays, accompanied by eight maps, entitled *Nos Frontières de l'Est et du Nord*, from the pen of a distinguished French officer, General Maitrot, has recently been published by Berger-Levrault, of Paris. This volume has the merit of being quite up to date, for not only have the essays been written since the beginning of 1911, but the majority of them have been revised in the years subsequent to the date named. In these essays are discussed two main propositions which, prior to August, 1914, were of vital military importance to France and to Belgium in the event of a European war between the Triple Alliance Powers on the one side and the Entente Powers on the other, namely :—

1. Whether in such a war Belgian neutrality would be violated ? If so, what would be the plan of the main German offensive in the western theatre of operations ?
2. Whether in the same war Swiss neutrality would be violated ? If so, would either a German or an Italian movement, directed against the French right, take place through Switzerland ?

The first of these propositions involves the consideration of subsidiary problems relating to the organisation and war establishment of the Belgian Army, as also of questions affecting the permanent defensive works on the northern frontier of France. The author deals with these subsidiary matters in the volume under review.

These essays, having been written primarily with the object of providing the general public in France and in Belgium with information concerning military problems of importance to them, appeared originally in newspapers published in one or other of these two countries. The conflagration which is devouring Europe at the present time has put the theories propounded by the author to the severest of all tests ; a perusal of his work discloses the fact that he has forecasted coming events with a remarkable degree of accuracy. 'Tis this fact which should enhance rather than diminish the

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interest of students of strategy, whether of a lay or of a professional order, in the contents of this little volume, in spite of the fact that the specific *raison d'être* of the essays passed away with the summer of 1914. There are probably many who may not, just now, have time enough on their hands to study the original French text; it is in the hope of affording those so situated an insight into the contents of this volume that the following abridgment of General Maitrot's work has been prepared.

I. Troops Stationed on Frontiers.

The first essay of the series deals with the question of "troupes de couverture"; it was written in June, 1911, and revised in July, 1914. The author points out therein that in these days when so large a use is made of railways, the working of which can be so easily interfered with by the enemy's agents and by ill-intentioned persons, whether aliens or subjects of the State, the period required for the concentration of national armies after the outbreak of war has become increasingly critical. Apart from the risk of interruption of home railways, yet another peril threatens a belligerent in his own territory: A sudden unexpected attack by the enemy whilst one's own troops are being disembarked in their concentration zones. In countries having contiguous land frontiers with those of a possible enemy "troupes de couverture" are employed to prevent disaster overtaking armies during the mobilization period. Prior to the outbreak of the present war the 2nd, 6th, 7th, 20th and 21st French Army Corps and the XV., XVI., XXI. and part of the XIV. German Army Corps were deliberately stationed in the frontier belts of the two countries to meet this very requirement.

The author thus postulates the conditions which should be fulfilled in connection with the organization and employment of "troupes de couverture":—

(*a*). They should possess the power to mobilize extremely rapidly; there should be no waiting for reservists to make up war establishments, but each unit should occupy the position assigned to it, being provided for this purpose with a peace establishment higher than that adopted for troops in the interior.

In France this condition was met by making the peace establishment of a company assigned for "couverture" duties double that of a normal company. The Law of 1913, which authorized three years' service with the colours, enabled the military authorities to rectify the serious position which existed, prior to the passing of this Law, during the period of discharge of one class of recruits and the incorporation of the last-joined levies, *i.e.* between the 25th September of one year and the 1st March next following; this was the period during which Germany could have launched a sudden attack on France with the greatest prospects of success on her side.

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(*b*). They should obtain deep knowledge of the topography and resources of the portion of the frontier belt assigned to them and also acquire an aptitude for turning to their own advantage the obstacles and defensive positions existing in this area.

(*c*). They should be trained so as to become active, vigorous, and supple in manœuvre and should be commanded by generals possessing, in a high degree, sang-froid, decision, energy, *coup d'œil*, and above all a stout heart and high character.

(*d*). They should consist of infantry with a proportion of artillery in excess of normal standards; the proportion of cavalry should be much below normal standards.

(*e*). The infantry and artillery of such a force should be supplied with ammunition on a liberal scale; 3,000 rounds per gun, and at least 300 cartridges per rifle to be at all times held in readiness at each station.

(*f*). The full war establishment of officers and non-commissioned should be assigned to each company and maintained thereat at all times.

II. German Offensive via Belgium.

The second essay discusses the question of "The German Offensive *viâ* Belgium"; it was written in September, 1911, and revised in July, 1914.

The author, in an introductory section to this essay, states that in recent years civilians in France, taking an interest in military matters, were continually asking the question: "Will the Germans attack us *viâ* Belgium and thus turn the left flank of our defensive line Verdun-Toul-Belfort?"

General Maitrot points out that the defensive works planned, after the loss of the Rhine frontier in 1870, for the above defensive line by General Séré de Rivière can, in a sense, never be completed, since modifications thereto must continually be taken in hand to keep pace with progress made in the science and art of artillery and fortifications. He states that concrete has already been added in many cases as a protection against the use of high-explosive shell and asks what steps it will next be necessary to take to afford security against aerial attack?

For nearly 40 years Frenchmen have lived with the idea uppermost in their minds that some day their army would be required to take up positions on de Rivière's fortified line, in order to meet there a new attack by German armies attempting to advance through Alsace and Lorraine into their country. During this period no thought was given to the possibility of attacks being launched *viâ* Belgium, the Grand Duchy of Luxemburg, or Switzerland. The phrase, "The neutrality of these countries covers us," contained one of the articles of faith which was firmly held by the French people. It is well known that General de Rivière did not count on

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the efficacity of the Treaty intended to secure the neutrality of Belgium. For this reason it was that he projected the creation of powerful strongholds at Lille, Maubeuge and Rheims, on the Belgian frontier, and at Bensançon, Dijon and Langres, on the Swiss frontier, to form wings to and in order to support the flanks of the front Verdun-Belfort. Unfortunately, other demands were more urgent and the French Government was not able, in consequence, to provide the funds required to complete de Rivière's scheme in its entirety. The situation is summed up by the author in the following terms :—"We have fast closed the front door of our house, but the side doors have we left ajar : it is by these latter that our enemy will enter."

It was a woman who first called attention to the dangers of a German offensive directed against France *viâ* Belgium : Madame J. Adams having made a trip in the Rhine Provinces publicly made known her view that the possibility which existed of from 50,000 to 60,000 Germans being easily and rapidly concentrated against Malmédy, was a peril requiring attention at the hands of the responsible advisers of the French Government. Although the suggestion was first met with ridicule, in time it came to be discussed seriously and finally attracted public attention. Novelists were tempted to dress up the subject in attractive garments ; one of these described the activities of an aerial squadron, based on Verdun, which was assumed to have received orders to proceed on reconnaissance duties to the quadrilateral at the angles of which are situated Aix-la-Chapelle—Coblentz—Treves—Cologne ; within this region the author suggested the German General Staff had concentrated 300,000 men for the purpose of turning the French left. The ear of the people was gained and the possibility of a German offensive against France *viâ* Belgium became a practical problem requiring serious consideration. It is this problem which the author discusses in this essay, but instead of founding his arguments on the hypotheses of romance, he bases his analysis on military possibilities and irrefutable documentary evidence.

The possibilities of a German invasion of Belgium have long been within the contemplation of responsible officers in that country and since 1880 much attention has been given by them to the study of the problems connected therewith. Two schools of thought on the subject have existed : the partisans of the German offensive by the left bank of the Meuse, to this school belonged Generals Brialmont and Dejardin ; and those who were persuaded that the German offensive would be directed along the right bank of the same river.

In 1882, Brialmont formed the opinion that the increase of the French garrisons on the front Verdun-Toul-Epinal-Belfort, the strengthening of the defences on this front, and the improvement of the French railway network in this region had so enormously strengthened this defensive line that the Germans must have been

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compelled to make a serious study of the problem of how this line ought to be turned by an offensive movement starting from a latitude north of Verdun and directed towards the banks of the lower Meuse. He came to the conclusion that, in a future war, the bulk of the German armies would attempt to hold the bulk of the French armies on the front Verdun-Toul-Belfort and, at the same time, a German army, consisting of three or four army corps accompanied by one or two cavalry divisions, would endeavour to cross the Meuse between Liège and Maëstricht in order to penetrate into France *viâ* the Sambre Valley. He further suggests that the connection between the bulk of the German forces, facing the line Verdun-Belfort, and the flanking army, directed on to the Sambre Valley, would be maintained by a single German army corps which would push its way through the Belgian Ardennes and the Grand Duchy of Luxemburg in order to reach the middle Meuse, debouching thereon between Givet, Mezières and Sedan.

Under the conditions which prevailed at the time that the foregoing opinion was formed, it was calculated that the German army for the flanking movement could be concentrated in the neighbourhood of Aix-la-Chapelle on the 10th day of mobilization. The distance from Aix-la-Chapelle to Maubeuge *viâ* Liège, Namur and Charleroi is 180 km. (about 112 miles), *i.e.* seven days' march; therefore, it was expected that this German army would arrive on the French frontier on the 17th day of mobilization, or about the same day on which the bulk of the German armies ought to complete their deployment before the front Verdun-Belfort. It must be remembered that when Brialmont gave expression to the above opinion the modern Belgian defensive system did not exist; the entrenched camps of Liège and Namur were a later creation and completed first in 1898. However, even after the date last named, Brialmont adhered to his opinions of 1882. He held a German offensive along the right bank of the Meuse to be inadmissible by reason of the considerable topographical difficulties of this region, as also of its very poor resources, characteristics which would have involved a too wide separation of the various columns of the army. Brialmont believed that in spite of the creation of the entrenched camps at Liège and Namur, the Germans would still endeavour to carry their offensive movement into France along the left bank of the Meuse, but points below Liège, probably between Visé and Maëstricht, would be selected for the passage across the river, and the German flanking army would then attempt to push forward *viâ* Tongres, Avennes and Gembloux, or even *viâ* Saint-Trond and Tirlemont; meanwhile the defensive positions of Liège and Namur would be invested by containing forces. This change in the line of advance of the flanking army does not materially increase the distance to be covered as compared with that considered under the earlier hypo-

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thesis; that is to say, that in the later case also there would be every prospect of obtaining simultaneity in the execution of the German movements on the northern and eastern frontiers of France.

The question of the German offensive *viâ* Belgium was again taken up in 1900, this time by General Ducarne. He held the view that the German offensive along the left bank of the Meuse directed on to the Sambre (predicted by Brialmont) was too eccentric, and, therefore, there would not be sufficient connection between the German forces operating in the two theatres. Ducarne gave reasons for the opinion, which he had formed, that the only offensive movement open to the Germans was that along the right bank of the Meuse, through the Belgian Ardennes. He examined the situation with a view to determining the base from which the German offensive would be launched; that of Aix-la-Chapelle appeared too eccentric to him, but he considered three other cases:—

i.—Base at Eupen, thence by Comblain and Marche either *viâ* Beauraing on Givet or *viâ* Gedinne on Fumay. He was of opinion that this road passed too close to Liège; moreover, it is closed at Givet by the citadel of Charlemont and it debouches at Fumay into very difficult country. Thus it is out of the question and so also are all roads to the north of it.

ii.—Base Malmédy-St. With: the roads starting from it are good and numerous, the three principal being:—

(*a*). Malmédy-Marche-Gedinne-Fumay.
(*b*). Recht-La Roche-Monthermé, with a branch *viâ* Gespunsart to Nouzon.
(*c*). St. With-Libramont-Sedan.

This group of routes possesses the advantage that these roads do not penetrate into the valley of the Chiers and by their use the fortress of Montmédy is turned. German forces advancing by them would reach the Semoy in six to seven marches, *i.e.* on the 16th or 17th day of mobilization. These roads, however, traverse a very broken, poor and desert country.

iii.—Base St. With-Treves: the roads starting from it are numerous and excellent, the principal being:—

(*a*). St. With-Libramont-Sedan.
(*b*). Prüm-Neufchâteau-Nouzon (and Stenay).
(*c*). Bitburg-Rodange-Stenay.
(*d*). Treves-Arlon-Stenay (Montmédy can be easily turned from Virton *viâ* Somme—Thonne—Thonne-le-Thil, Stenay being gained by Chauvency St. Hubert).

The country traversed by these roads is rich and populous, and in parts there are railways running almost parallel to the roads; the use of these railways would prove exceedingly useful for supplying the troops. A flanking army marching by these roads could easily

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maintain connection with a force operating on the front Verdun-Belfort. Ducarne came to the conclusion that a German offensive movement would be launched from the base St. With-Treves; probably three to four army corps and one cavalry division would be detailed for this purpose, and this force would reach the Chiers on the 16th or 17th day of mobilization; at the same time, another German army consisting of two to three army corps and one cavalry division would be ranged on the front Malmédy-St. With-Eupen for the purpose of observing and containing the Belgian Army. That is to say, in his opinion, the Germans would push five to seven army corps and two cavalry divisions into the Grand Duchy of Luxemburg and into Belgium, and of the 200,000 men so employed, 80,000 would be placed facing the Belgian Army.

In 1905 another Belgian officer, General Dejardin, examined the same problem; he came to the same conclusion as Brialmont. He expressed the opinion that the attack along the right bank of the Meuse was ruled out as not complying with strategical conceptions. The problem has also been discussed in Holland; informed Dutch opinion inclined to the view that the German offensive against France would be directed *viâ* Belgium.

In a second section to this essay the author examines what, at the time of writing, might be termed "the present-day solution" of the problem. He points out as a striking fact that publicists, who have treated this problem, have maintained a strict silence on the subject of the Belgian Field Army, although allusions have frequently been made by them to the difficulties the German offensive will meet with owing to the modern fortifications in existence at Liège, Namur and Antwerp. At the date on which this essay was first written the organization of the Belgian Army provided for its distribution as follows:—

I. Garrison troops: these were to consist of the units specially set apart for holding defence works and also an infantry division and two independent infantry brigades detailed for the active defence of Antwerp, Liège and Namur.

II. Field troops: these were to consist of two army corps and two independent cavalry divisions (*i.e.* about 80,000 men), provided with the latest perfections in the matter of equipment and in possession of a field piece quite equal to the German field gun.

The new Recruiting Law of 1909, to which Leopold II. had attached the Royal Sign Manual on his death-bed, was not passed with the object of increasing the Establishment of the Army, but rather to raise the standard by enforcing personal service. The Establishment of the Belgian Army was, at this time, as follows:—

On peace footing	..	45,000 men.
On war footing	..	180,000 men.

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In 1905, General Dejardin had stated that the Belgian Army must remain on the left bank of the Meuse, with its first line on the front Liège-Namur. It seems then that the Belgian Government had decided to abandon the Ardennes and the right bank of the Meuse to the enemy, no doubt for the reason that it was not considered desirable to separate the army too widely from the sea and Antwerp —the points of contact of Belgium with Great Britain.

The author makes the comment that the concentration of the Belgian Army in the zone indicated by Dejardin might be in contemplation, but "to admit that the Belgian Army would remain passive in the presence of an invasion by the left bank of the Meuse, to admit that it would not oppose, by arms, an invader who, in defiance of international law, would be violating the peace and quiet of the most valuable provinces of Belgium and who would further be marching to offer insult to a people in its very capital, that is a wrong which we refuse to do to this army and to the whole Belgian nation." He predicted that if the Government did desire thus to remain passive then "in such a case, the rifles will go off on their own accord, the more so by reason of the fact that the sympathy for France is, in Belgium, very real so far as the majority of the nation is concerned." The author continues: "We do not hide from ourselves that German influence is gaining ground day by day in Belgium. In Antwerp alone there are 60,000 Germans; they have gained a footing in our commerce, industry and finance. The German population is a veritable advanced guard. The same sort of thing occurred in 1870, and it is well known that in the Champagne District, when the Germans entered Rheims, their troops were guided by former employés of large wine merchants; such employés, all of Teuton origin, had rejoined their corps on the outbreak of war. They were familiar with all the resources of the town, the fortunes of the magnates with whom they had served and those from whom they had received hospitality; they were thus able to assist the German authorities to strike with a sure hand and, by the great accuracy of their reports, deprived their victims of every means of defence and protest."

In Belgium the system described had been perfected; many Germans had intermarried into Belgian families and had taken out letters of naturalization. The author asks the question whether the foregoing reasons will prompt these Germans to "act any the less as '*indicateurs*' at the disposal of the German Great General Staff?" and continues—"They have the keys of our house in their hands. Knowledge of the mentality developed by pangermanism amongst its votaries throws doubt on the wisdom shown by Belgium in admitting these 'pioneers' of greater Germany to its citizenship." It was also known that Brussels was the centre in which was located the German Intelligence Department charged with supervision of

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the espionage system established to deal with Belgium, Holland, France and England; this centre reported to Aix-la-Chapelle and Cologne. General Maitrot recognized that this German infiltration into Belgium seriously reduced French influence in that country.

The theatre of operations, in which it was expected by some writers that the German flanking army would attempt to make a diversion, lies between the Meuse and the Scheldt and forms a polygon, having at its angles Antwerp, Charlemont, Liège, Namur and Maubeuge—depth, 125 km. (about 78 miles), greatest diagonal, 150 km. (about 94 miles). It was assumed that this polygon would play a *rôle* in Belgium analogous to that of the famous quadrilateral, Verona-Legnano-Mantua-Pescheira of Lombardy, and it was argued that a defensive army based on the centres at the angles of the polygon would be able to offer a vigorous resistance to an army acting on the offensive against it, even one superior to it in numbers. It was assumed that Liège, Namur and Antwerp were capable of a long and vigorous resistance against any forces and guns the Germans might at that time have been able to bring against them. Having considered the means of defence available in Belgium, the author puts the question: Would the Germans risk an attempt to force an entry into the polygon aforesaid by a flanking army (of the strength suggested earlier in the essay), given that the centres at the angles of the polygon were *strongly fortified* and the Belgian Army was to be used to put up a strenuous defence? At the time this essay was written, the author was of opinion that under the conditions then existing, the eventuality of *such an offensive movement* on the part of the Germans might be set aside.

The reason given by some writers for rejecting the probability of an offensive movement along the right bank of the Meuse was that the forces so employed would have to traverse a poor and difficult country; a country admirable for franc-tireur warfare, but deplorable for the manœuvres of a regular army. General Maitrot states that a study of the topography of this country shows that the foregoing description is only partially true. He divides the region on the right bank of the Meuse into three distinct zones, as follows:—

(*a*). The valley of Meuse, together with the districts of Condroz, Famenne and Herve: this is a rich country, easily traversable by an army.

(*b*). The Ardennes properly so called, including the Hautes-Fagnes, the plateau of Tailles and the Hohe-Venn: this is a poor country with arid plateaux and thick forests, the soil is partly rock and partly marsh land; its highest point is more than 2,000 ft. above sea level; the roads across it are numerous but traversable only with difficulty.

(*c*). The Gutland (literally: good country); in this region lie the south-east portion of the Grand Duchy of Luxemburg, Belgian

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Luxemburg and the valley of the Moselle: the roads are excellent, the country rich and suitable everywhere for military purposes.

The author agrees with General Ducarne that any offensive movement which the Germans might have attempted with a flanking army (*i.e.* about the year 1912) would have been launched from the base St. With-Treves with the object of effecting a development on the front Sedan-Stenay and that, at the same time, an army of observation would have been retained on the base St. With-Malmédy. He considered that the lay-out of the railway network in this region, at that date, afforded something in the nature of direct evidence in support of the case stated by him. A map, showing the railway system of this region as it existed in 1908–9, indicates that four railways starting from centres on the Rhine gave access to the valleys of the Meuse and the Chiers, namely :—

(1). Cologne—Aix-la-Chapelle—Malmédy—Jemelle—Dinant.
(2). St. With-Ulflingen-Bertrix.
(3). Neuwied-Gerolstein-Ettelbrück-Montmédy.
(4). Coblenz-Treves-Luxemburg-Longwy.

These railways were, at the date given, incomplete; previous to the autumn of 1911, the Germans had spent some 40 millions sterling on the construction of railways leading from the Rhine to the Belgian frontier and on the Guillaume-Luxemburg Railway, and, at the date last mentioned, further important works were in execution. At centres of no importance whatever a considerable mileage of sidings and platform accommodation had already been provided; the expenditure involved in these cases could not be justified on the grounds of the commercial and industrial necessities of these localities. The author sums up the situation thus: "Truth to tell the Germans have provided in the Rhine country, particularly in the vicinity of Treves and Luxemburg, a base as strong as that in Lorraine."

The Germans admitted, at the time, that the four railways referred to—to which the author applies the term "voies pénétrantes"—had a carrying capacity equal to the demands likely to be made upon them by seven army corps, operating in this region. Assuming then that the Germans would retain the principal part of their army to face the French on the line Verdun-Belfort and that a decisive flank attack would be attempted round the French left, accepting also the German view as to the carrying capacity of the "voies pénétrantes," the author arrived at the following conclusion with regard to the possibilities of a German flank attack :—

"The German offensive will be launched from the base St. With-Treves, seven army corps and two cavalry divisions being employed for the purpose; two of these army corps with one cavalry division

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will take up positions about Malmédy and remain in observation of the Belgian Army. The remaining five army corps with one cavalry division (about 200,000 men) will advance across the Grand Duchy of Luxemburg on to the front Sedan-Carignan-Stenay. These forces will be concentrated by about the 10th day of mobilization. The distance of the base St. With-Treves from the Semoy being from 110 to 120 km. (about 69 to 75 miles) the larger of the two bodies will reach the French frontier about the 16th day of mobilization." The author quotes von Bernhardi in support of the view here expressed by him, and sums up the leading features of the German plan of campaign ready for use at that date in the following terms:—"Containing, wearing down attacks in Lorraine on the front Verdun-Toul; decision to be obtained *viâ* Belgium."

The author concludes this essay by discussing, in a final section, what at the time he considered would be the "solution of the future," but which solution had so far matured at the date of the outbreak of the present war as to become really the "solution of the moment." He explains, in an introductory paragraph, the sense in which he uses the expression "solution of the future," pointing out that within a definite given time the plans of concentration of the French and German armies will have been modified by force of circumstances so as to correspond more nearly with certain new conditions: the date when circumstances permit these modifications to be effected represents the "future" date which the author has in mind.

In 1870, 518,000 Germans were concentrated in the first line on the left bank of the Rhine on the line Landau-Mayence-Coblenz (Landau to Coblenz=75 miles), and were formed into three armies. The objective of the I. and II. Armies was Metz; the I. Army had the route *viâ* Treves and Sarrelouis assigned to it and the II. Army the route *viâ* Mayence and Kaiserslautern. The III. Army was, in the first instance, to be retained at Landau, in order to threaten Alsace and Strassburg. These armies occupied positions from which they could effectively support one another.

On the French side was disorder and chaos. It had been hoped to concentrate 550,000 men on the frontier; with extreme difficulty 250,000 men only were collected on the line Belfort-Thionville—on a front exceeding 125 miles—as follows:—1st Corps at Strassburg; 2nd Corps at St. Avold; 3rd Corps at Metz; 4th Corps at Thionville; 5th Corps at Bitsche; 6th Corps at Chalons; 7th Corps at Belfort; Guard Corps and Reserve Artillery at Nancy; Reserve Cavalry at Luneville. The French Corps were spread over too wide a front and were without connection with one another; not one of them had any orders or any objective assigned to it; all waited and their movements were dictated by the success of the enemy's strategy. Everything was wanting in the army—money, supplies, camp equipment, gun and transport teams; gross carelessness

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prevailed everywhere, contempt for every rule of war was exhibited. Chastisement followed swiftly; defeats at Wissemburg, Wörth and Spicheren were followed by disasters at Sedan and Metz comparable only with those associated in history with the names Poictiers, Crecy, Agincourt, Jena. For 40 years and more Frenchmen have laboured assiduously and continuously in order that the land dear to them may never again be overtaken by misfortunes of the magnitude which engulfed their fatherland in 1870. The first matter which preoccupied their attentions was the strengthening of the new eastern frontier assigned to them by their conquerors; the consideration of this question was submitted to General Séré de Rivière. The scheme drawn up by the latter was put into execution; it provided along the new eastern frontier the two fortified ramparts Verdun-Toul and Epinal-Belfort. The central gap of Charmes and the Dun-Stenay gap between Verdun and the Belgian frontier, designedly left without fortifications, had in view the *canalization*, so to speak, of the course of the German offensive. The intention was that the French Army should, in the event of a diplomatic rupture becoming inevitable, concentrate in security under the shelter of the aforesaid fortified ramparts in a position to oppose any attempted invasion into France by either one, or both, of the gaps referred to.

The only reproach which has been directed against the above scheme is that Toul was chosen, and not Nancy, to form the southern flank of the northern rampart. The surroundings of Nancy lend themselves better than do those of Toul for the creation of a strong place of arms; however, the fortifications of Toul already existed in 1870, and therefore it was only necessary to effect certain improvements there, whilst on the other hand, the fortifying of Nancy would have involved the creation of an entirely new and comprehensive scheme of defence. Under the circumstances it was felt that it would be better to leave Nancy an open town and save it from the horrors and destructive effects of a siege, should war unfortunately break out before the defence preparations were completed. Further, in the case of urgent necessity Nancy could be provided later with powerful field defences.

Of the two gaps left by de Rivière on the eastern frontier that of Charmes was the more important. Should the Germans have decided to mask Toul and Epinal, with two or three army corps each, and to march through this gap into the Department of the Haute-Marne, a preliminary success to their arms in the neighbourhood of Neufchateau would have made them masters of the Seine Valley and given access to the shortest route to Paris, that *viâ* Bar-le-Duc, St. Dizier, and Troyes. This route passes through a very rich country, easily traversable, and lends itself admirably to the manœuvres and operations of a considerable army. In fact, it

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is the theatre of operations of the 1814 campaign, and it was through this same region that the Crown Prince of Prussia led his army in 1870, after the Battle of Wörth, in pursuit of MacMahon who was believed to be in retreat on Paris.

The situation in regard to the Dun-Stenay gap is different. Should the Germans have decided to mask Verdun and to cross the Meuse they would have found themselves, on the left bank of this river, in a very much more difficult country; for this is the Argonne country in which, it has long been held, the French could offer a most desperate resistance to any invader. It cannot certainly be argued that the Argonne can play the same *rôle* to-day as that which is related of it in the history of the 1792 Campaign. So much has been done in recent times to improve the condition of the routes in this region that its five famous defiles—the Thermopylæ of France—could now easily be turned and even commanded. The Argonne forms a natural fortress and cover the region, on the left bank of the Meuse, situated south of the Dun-Stenay gap. Should the Germans have succeeded in occupying the Argonne they would have found themselves in a poverty-stricken country, famous for its sterility and waterless condition—the Champagne Pouilleuse which the army of Brunswick found itself unable to traverse in 1792.

It was felt that if the Germans did attempt to penetrate into France by the Dun-Stenay gap it would only be for the purpose of effecting cavalry raids against the French communications and in order to prevent reservists from rejoining the colours and supplies from reaching Verdun. It was fully expected that the main German effort would be made *viâ* the gap of Charmes—the sidings and platforms constructed in Alsace and Lorraine indicated that the mobilization and concentration of the German Army had probably been worked out to this end—as it was recognized in Germany that in recent years the four *points d'appui* of de Rivière's ramparts had become practically impregnable and that therefore it could hardly be contemplated that siege operations against one or more of them could be brought to a successful issue within the comparatively short period of time that seemed essential to the German Great General Staff to gain the end in view.

Originally the defences of Verdun occupied a perimeter of 32 km. (about 20 miles), later an outer line of detached forts were provided increasing the perimeter to 47 km. (about 29 miles), more recently the construction of a third line of works had been under consideration. Toul and Belfort have grown similarly to Verdun; Epinal has also grown but a little less so. Not only have the *points d'appui* been strengthened and reinforced, but the intermediate portions of the ramparts and the gaps also have not escaped the attention of the military engineer in these respects.

The Germans had, during a long period, hoped that they would

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be able rapidly to reduce and occupy one of the intermediate positions on the northern rampart. Expecting to accomplish this purpose sufficiently early during the mobilization period, the Germans calculated on being able to thrust the French "troupes de couverture" on one side, to reach the Meuse quickly, turn both Toul and Verdun, to seize the direct railway to Paris, *viâ* Bar and Chalons, and thus to find themselves in a position to cover successfully the right flank of the grand attack, the great blow intended to be delivered *viâ* the gap of Charmes. General Maitrot expresses the opinion that, in view of the resistance which the old bastioned works of Paris offered in 1870, it was likely the Meuse forts would prove capable of more strenuous resistance than was anticipated by the Germans who might, in consequence, experience a grievous disappointment. He considers that one irremediable error has been committed in connection with the eastern defences of France, that connected with the reduction of the width of the two gaps referred to.

The distance of Toul from Epinal is 65 km. (about 40 miles); the whole space between these two places constituted the original gap of Charmes. Near Toul, the plateau of Frouard now bristles with batteries and works; the fort of Pont St. Vincent, situated on an eminence of this plateau, bars and commands the direct route Nancy-Neufchateau. This collection of works constituted an important fortified group which would prompt the Germans to direct their offensive movement in territory well south of these defence works, but even in this case they would meet an obstacle in their advance, namely the fort of Manonviller which commands the direct railway from Sarrebourg to Charmes, *viâ* Luneville. The fort of Manonviller has been retained for political rather than for military reasons, and the strengthening of this position has caused the gap of Charmes almost to disappear—its width is now only 40 km. (about 25 miles).

The Germans commenced the 1870 Campaign with half a million men, and those who were well informed expected that, in their next war with France, they would make a commencement with 1,000,000 men. Prior to the outbreak of the present war the question in respect of which an answer was being sought was: In view of the serious modifications effected in the gaps provided under de Rivière's scheme what is likely to be the German plan of campaign in the Western Theatre? Here is General Maitrot's reply to it: The masses of the German armies pressed as against a Chinese wall, having no outlet along their front, are about to escape and slip away towards a flank, towards their right wing, towards the Rhine provinces and Belgium. Based on the Rhine, supported by the fortified centres at Mayence, of Coblenz and of Cologne, in easy communication with Central Germany by means of an extensive railway network, possessing along its front vast spaces for deployment

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and manœuvre, having numerous suitable routes at its disposal, the German armies would be able to effect their preliminary concentration under the most favourable conditions in the Rhine provinces; they would concentrate in their own home and not in enemy country—as would be the case in the event of a concentration in Alsace-Lorraine. The difference between the new and the old conditions was something not to be despised.

In effect, the change in the concentration plan foreshadowed above, meant the shifting of the Centre of Gravity of the German land forces facing the eastern frontier of France: instead of a Central Force stationed in Lorraine, with a detached wing in the region Aix-la-Chapelle—Treves—Cologne, such indications as existed pointed to an intention on the part of the German Great General Staff to effect an exchange in the concentration zones of the Central Force and its right wing. Although the German Army in Lorraine would then become too weak to be employed for the purpose of forcing the French frontier, yet those who were well informed suspected that the German Great General Staff could never have intended to employ the new left wing merely as an *armée d'observation*. The execution of the main German effort in the west, it was argued, would be assigned to the armies on the right of the line—the Central Force—which, advancing on to the Meuse from the Rhine provinces and from the Palatinate, would march through Belgium and the Grand Duchy of Luxemburg. Thus would be justified the expression "the decisive attack" employed by von Bernhardi to describe the nature of the offensive against France to be undertaken *viâ* Belgium by the German hosts.

The prospective displacement of the axis of the main German concentration zone west of the Rhine, which was to convert what has been referred to as the "Solution of the Future" into the "Solution of the Moment," immediately preceding the outbreak of the present War, imposed upon the Germans the necessity of multiplying the number of defence works in Alsace-Lorraine, in order firmly to bar every route by which French armies could obtain access to German territory. This work had not been neglected by them. At the beginning of the 19th century, there were but two fortified centres in Alsace-Lorraine, Metz and Strassburg; from the defence point of view even these could not be classified as "kolossal." Could the French Army obtain a substantial victory in the Woëvre, Alsace-Lorraine would have been laid open to them. In this connection a plan of campaign had been discussed by military writers who proposed that a French Central Force should be pushed directly on the Rhine along the route *viâ* Saareguemines—passing between Metz and Strassburg—whilst an independent army, on its right wing, should move from the vicinity of Belfort, descend on Alsace and Baden and threaten the left flank and rear of the German forces.

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This scheme involved the masking of Metz by an *armée d'observation.* The Germans took good care that the foregoing plan should not be realizable. They met these proposals by constructing at Istein a group of defence works destined to bar the railway from Basle to Strassburg *viâ* Friburg and, at the same time, to bring under artillery fire a locality particularly favourable for the establishment of bridges for the passage of the Rhine. Defence works were also constructed by the Germans at Altkirch and at Folgenburg, on routes leading from Delle and from Belfort to Huningue: these works create serious obstacles to an advance of French troops attempting to move northwards through the gap of Belfort; Neu-Brisach has been converted into a *tête de pont;* Strassburg which possessed 11 modern works and 5 intermediate works has been connected up with the fortified centre at Molsheim; Upper Alsace has been completely closed against any French offensive movement.

In Lorraine, Metz has assumed formidable proportions; a new line of 17 works, of the first class, has been provided, increasing the perimeter from 25 km. to 65 km. (from about 15·5 to 40·5 miles). Northwards Metz is now connected by means of the defences of Bousse with the new works at Thionville, Guentrange and Illange. It is not merely a defended town which now exists just beyond the French frontier, it is rather a strongly fortified region.

A distance of 75 km. (about 47 miles) alone separates the Vosges from the guns of Metz: this was the only gap left by means of which French troops could enter Alsace and even this gap is cut in two by the impenetrable zone formed by the ponds of Dieuze and the Houillères Canal. In fact there are two passages in the gap; on the north-west, the Morhange Passage, 35 km. (about 22 miles) wide, through which passes the main road from Nancy to Saareguemines; and that on the south-east, the Saareburg Passage, about 15 km. (about 9 miles) wide, through which passes the railway from Luneville.

General Maitrot held that it would have been madness to adopt any course which might have resulted in French troops being engulfed in the defiles referred to, menaced the meanwhile, on the one flank and on the other, by the immensely powerful fortresses of Metz and Strassburg. The Germans had, moreover, been credited with having formed an intention to construct a group of defence works on the Côte de Delme, near Moncheux; in the event of the execution of these works, the Morhange Passage would be barred and the Germans would then have effectually locked and bolted every door leading to the Rhine, in the same way that the French had already firmly shut those leading to the Meuse. It was estimated that five to six years, at the most, would be required by the Germans to accomplish the foregoing programme; on the expiration of this period the displacement of the axis of the principal concentration

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zone already referred to would automatically become an accomplished fact. This alteration in the German concentration zone would have to be met by a change in the French plans. It would become necessary for the French Central Force to concentrate on the front Verdun-Lille whilst, at the same time, an *armée d'observation* would have to be concentrated in Lorraine and on the Vosges.

The progress of events on the Rhine frontier were tending to convert Belgium once more into a cockpit: there would be solved the Alsace-Lorraine question, there would be decided the fate of France and the destinies of Europe.

General Maitrot was of opinion that his country had nothing whatever to lose by reason of the changes and modifications in progress at the date on which he wrote this essay; the lay-out of the railway network was quite suitable for a French concentration in the northern, as well as in the north-eastern regions of France.

III. Belgian Army.

The third essay of the series deals with "The Belgian Army"; it was written in January, 1912, and revised in July, 1913. In an introductory section, the author explains that in consequence of the appearance of his essay on "The German Offensive *viâ* Belgium," in the *Correspondant* of 10th September, 1911, he was invited by the editor of a Brussels newspaper to prepare an article on the Belgian Army; hence the present essay.

After quoting the provisions of the Treaty of 15th November, 1833, so far as they relate to the neutrality of Belgium, the author remarks that although these provisions contain a solemn obligation stated in precise terms, they will avail Belgium nothing unless she takes measures to have her rights respected by force of arms.

In this introductory section attention is further drawn to the views expressed by military men regarding the probable intentions of the German Great General Staff in the event of another war with France. An examination of the evidence available on this subject leads the author to sum up the situation in the following terms:—"We will conclude then by stating that a German offensive movement *viâ* Belgium is only too certain; there is nothing in it contrary to the rules of war formulated by the immortal Clausewitz. We must oppose this offensive movement with one of our armies, but this danger is best met by having at hand a Belgian Army, reorganized and reinforced, capable of taking the offensive and so situated as to be in a position to cross the Meuse, thus to threaten the right flank and rear of the German advance towards the west."

In a second section the author deals in detail with the peace establishment at which, in his opinion, the army should be maintained by the Belgian Government; this question is considered under the two heads: "Fortress Troops" and "Field Army." He

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explains that he has no precise knowledge concerning the Belgian defence works, the length of the crest line to be held, etc.; but assuming the conditions in Belgium resemble those in France, he puts forward the following estimate of the requirements under this head:—

Locality.	Perimeter.	Particulars.	Garrison for Works. Infantry.	Garrison for Works. Artillery.
Liège	50 km. (about 31 miles)	7 large and 5 medium works	1935	950
Namur	45 km. (about 28 miles)	5 large and 4 medium works	1470	700
Antwerp	Not stated	22 works of various kinds	3250	1530
		Total	6655	3180

Say 16 infantry battalions (of 500 men each) and 31 garrison batteries.

The author recommends that, in addition, one division apiece should be assigned for the mobile defence of each of the localities named above. The number of men to be provided under the designation "Fortress Troops" would therefore be as follows:—

Infantry ..	52 battalions	24,600 men
Artillery ..	31 garrison batteries 27 field batteries ..	5,800 men
	Total	30,480

At the date when the essay was written the Belgian Field Army consisted of two army corps and two cavalry divisions; the author recommends the addition thereto of, at least, a third army corps, one division of guards (to consist of twelve battalions, nine field batteries, one brigade cavalry, one horse artillery brigade of two batteries) and three brigades of heavy artillery (consisting each of three 2-gun batteries). The augmentation suggested would bring the peace establishment of the Field Army up to the following figures:—

Infantry ..	84 battalions	42,000 men
Cavalry ..	80 squadrons	10,400 men
Artillery ..	99 field batteries 6 horse batteries 9 heavy batteries ..	11,580 men
	Total	63,980

Under the scheme proposed the total peace establishment—due allowance being made for engineers, train, staff clerks, etc.—of the Belgian Army would have been raised from 45,000 to 100,000 men.

In a third section the question of war establishments is touched

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upon; on mobilization the above organization recommended by General Maitrot would provide the Belgian Army with:—

Infantry at 1,000 men per battalion (136 bns.) ..	136,000 men
Cavalry at 160 sabres per squadron (80 sqdns.) ..	12,800 men
Artillery at 200 men per battery (162 batts.) ..	34,400 men
Total	183,000 men

Including the accessory services and non-combatants, say a total of 200,000 men; behind this "first line" there should, in the author's opinion, exist reserves in sufficient numbers (say from half to two-thirds strength of first line) to fill casualties. Reserves at 50 per cent. of the first line would provide Belgium with an army, at war, strength of 300,000 men, in place of the 180,000 men at which the effectives stood in 1912. The question is next briefly considered whether the foregoing recommendations would be likely to demand too serious a sacrifice on the part of the Belgian people, and it is pointed out that comparatively poor countries are bearing a heavier burden in respect of national defence than rich Belgium; the following data concerning the armies of comparatively small countries gives a bird's-eye view of their military situation:—

		Establishment of Army.		Proportion of Army to Population.	
Country.	Population.	Peace.	War.	Peace.	War.
Bulgaria ..	4 millions	60,000	400,000	$\frac{1}{66}$	$\frac{1}{10}$
Switzerland ..	$3\frac{1}{2}$ millions	Not stated	310,000	—	$\frac{1}{11}$
Roumania ..	$6\frac{1}{2}$ millions	95,000	360,000	$\frac{1}{69}$	$\frac{1}{21}$
Serbia	$2\frac{4}{5}$ millions	40,000	350,000	$\frac{1}{70}$	$\frac{1}{8}$
Belgium ..	$7\frac{1}{2}$ millions	100,000	300,000	$\frac{1}{75}$	$\frac{1}{25}$

The establishments stated in the case of Belgium are, it will be seen, those recommended by the author. As a matter of fact, since the date on which this essay was first published the Belgian Chamber has passed a resolution—on 28th May, 1913—agreeing to a reorganization of the Army; this reorganization provided for raising the War Establishment of the Army to 350,000 men, of this number 200,000 men were assigned to the Field Army.

In a fourth section, entitled "Some General Considerations," General Maitrot draws attention to the possibility that the Germans might attempt a sudden onslaught on Belgium and France—the "attaque brusquée"—with their "troupes de couverture" without, in the first instance, declaring war. He recommends that, in order to guard against the Belgian Army being disturbed during the period of mobilization and concentration, all that part of Belgium which lies on the right bank of the Meuse should be without any garrisons, in the same way that the French have ceased to maintain garrisons in the Woëvre region. On the other hand, the author considers

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that all points of passage over the Meuse, not only Liège and Namur, but also Visé, Huy, Dinant, etc., should be held by Belgian troops and that all the points so held should be covered by defence works. The units composing these "troupes de couverture" should, in his opinion, have their peace establishments increased, as in the case of the French "troupes de couverture"; further all bridges should be effectually prepared for destruction at a moment's notice. General Maitrot hoped that the adoption of the foregoing measures would result in breaking the German offensive as soon as it had reached the line of the Meuse, unless indeed an advance was made from the lower Rhine in overwhelming force and even then, he thought, the resistance of the Meuse defences would allow sufficient time to the Belgian Army in which to mobilize, and then either to move against the enemy's flank and rear or alternatively to join up with the French forces on the Semoy. He urges that the Belgian Government should set its face strenuously against the construction of "voies pénétrantes," since such railways favour the German offensive, and expresses the opinion that it is much to be regretted that the section of main line Malmédy-Stavelot has been constructed—it provides an independent line to Dinant *viâ* Rivage and Jemelle. The author recommends that all "voies pénétrantes" should be barred, where they cross the Meuse, by a fortress; since Liège and Namur each control one of the three railways falling in this category, only that passing through Dinant required to be dealt with. He doubts the wisdom of the Belgian Government in entering into an agreement with the German Government for the construction of the railway between Louvain and Aix-la-Chapelle *viâ* Visé; this railway shortens the route to the Belgian capital and its completion would, in his opinion, singularly facilitate the German offensive *viâ* Belgium.

IV. Ought Lille to Remain a Fortress?

In a fourth essay (written in February, 1912) the author discusses the question: "Ought Lille to cease to play the part of a fortress?"

This question became prominent in France in consequence of a discussion which took place at a meeting of the French Chamber, on the 26th March, 1911, on a Bill dealing with the abandonment of certain defensive works (including those round Lille). The part of the Bill relating to the enceinte and detached forts of Lille was, at the time, withdrawn, and the decision as to the fate of the fortifications of this important town was thus left in the hands of the Senate.

The author raises three questions:—

(1). Ought the defences of Lille to be retained and improved?

(2). Ought the enceinte to be suppressed and the detached forts maintained?

(3). Ought the whole of the defences to be razed to the ground and Lille itself made an open town?

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General Maitrot agrees with those who had been arguing that the enceinte of Lille no longer possessed the same military value as of yore, since it was now masked by the existence of suburbs as important as Lille itself; he points out that the detached forts are not only too close to the town—only 6 km. (about 3¾ miles)—but are also not strong enough to resist modern high-explosive projectiles. To protect a modern town against light 21-cm. siege mortars—capable of firing a 30-kg. (about 66-lb.) shell a distance of 14-km. (about 8¾ miles)—which the Germans were known to possess, detached works are required a distance of from 8 to 9 km. from the outskirts of the town. A ring of detached works placed approximately along the circumference of an imaginary circle of 9-km. (about 5½-mile) radius, with the citadel of Lille as centre, would bring the defences of this town, at their nearest point, within 3·5 km. (about 2 miles) of the Belgian frontier; the new German forts at Metz are equally close to the French frontier. The author does not consider that any inconvenience results from such close proximity of defence works to a frontier, and holds the opinion that Lille can be converted into a modern entrenched camp, but that an enceinte is indispensable; he admits that at certain points the existing enceinte may require remodelling and at these points the provision of a sunken iron palisading is recommended.

To those who estimate that the new works necessary at Lille would cost 300,000,000 francs, General Maitrot makes answer: Works placed along the circumference of a circle having a radius of 9 km. (about 5½ miles) would give the defences a perimeter of 54 km. (about 34 miles). Assuming that the detached forts are placed 6 km. (about 3¾ miles) apart, nine works in all would be required, say five large and four medium-sized forts; the cost of the former type would not exceed 3,000,000 francs per fort whilst those of the latter type could be constructed at a cost of less than 2,000,000 francs per fort, giving a total of 23,000,000 francs for the nine forts. A further sum of from 4,000,000 to 5,000,000 francs would have to be expended on narrow-gauge (60-cm.) railways and magazines for each sector of the defence, whilst another 7,000,000 francs would provide sufficient funds for gun batteries, intermediate defence works, purchase of ground, etc., bringing the proposed grand total expenditure to 35,000,000 francs. *Per contra*, the sale of parts of the site of the old enceinte would realize a handsome sum, which the War Department would be in position to apply towards the reduction of the expenditure on the new defences. The author expected that the works proposed by him would take three to four years to execute, so that the Legislature would have been required to vote annual credits of from 8,000,000 to 10,000,000 francs only.

General Maitrot had already contributed an article on the subject of this essay to the *Correspondant*, it appeared in the issue of that

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paper for the 10th September, 1911. In this article the strategical relations between France and Germany are again briefly reviewed; his conclusions on the subject have been stated in an earlier part of this abridgment. Put shortly they are: On the Lorraine front there will only be a feint; the principal German effort will be made on the Meuse from Maëstricht to Givet; Belgium will become the cockpit in which France and Germany will settle their quarrels. To meet this German plan of campaign, the concentration zones of the French armies must be changed: the French right will be supported by Verdun, its left must rest on Lille and Dunkirk; *corps d'observation* will alone be left on the Lorraine front. Hirson which bars the gap of the Oise; Maubeuge which closes the door at the Sambre; Lille which covers Flanders; Dunkirk which holds the sea are all called upon to play, on the Flanders front, a *rôle* similar to that assigned to Toul, Epinal-Belfort on the Lorraine front. The author is convinced that "Everything indicates that the 'Solution d'Avenir' is about to be realized immediately," and, referring to the German works then under construction in Alsace-Lorraine, he states: **"It is estimated that, in three to four years' time, that is to say in 1914, all these defence works will have been completed:** the Germans reassured then as to the safety of their left flank will transport the bulk of their Army to the Rhine Provinces. Three to four years, that's the time France has at her disposal, in the which to create the 'front de Flandres'; that is for improving the defences of Hirson, completing those of Maubeuge, and creating an entrenched camp at Lille—the most indispensable of all. Flanders without its Lille would be the eastern frontier without its Belfort."

V. A Last Word on the German Offensive viâ Belgium.

The fifth essay of the series (written in September, 1913) is entitled "A last word on the German offensive *viâ* Belgium." The author refers briefly to his previous essay on the same subject (the second of this series) which had attracted considerable attention, so much so that extracts therefrom were read in the French Chamber, on the 8th July, 1913, in the course of a debate on frontier defence. The author remarks that although progress had been made in bringing home the nature of the German menace, nevertheless, there still existed a want of unanimity of opinion on the subject. There were even military men who contested the suggestion of a German offensive *viâ* Belgium on the following political and military grounds:—

Political reason:—"Belgium is neutral, her neutrality was solemnly recognized by Europe in 1833, Germany on her part will respect it."

Military reason:—"A German army of 200,000 men operating in Belgium would be isolated, it would be without "liaison" with the armies of Lorraine; should it meet with a check, its retreat might

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become compromised in a disaffected country; there would follow in its pursuit a Belgian army, which is no longer to be despised, now that Belgium has reorganized her army and brought her war effectives up to 350,000 men, of which number 200,000 soldiers constitute the Field Army."

The author points out that all the criticisms directed against the views propounded by him fail the moment the Germans are ready to hurl the bulk of their forces into Belgium with the intention of pushing their way through this country, not only by the Dun-Stenay gap but also by the routes across the northern French frontier, with the heart of France as their objective. The idea of an attack directed by Germany against France *viâ* Belgium is nothing new; it has occupied the attention of Germany for many long years. Evidence in support of this statement is to be found in the *Military Correspondence of Field Marshal Von Moltke*, published by Ernst Siegfried Mittler und Sohn, of Berlin.

It is necessary to carry one's memory back to 1858. On the 10th December of that year there was signed, between Napoleon III. and Victor Emmanuel, an offensive and defensive Alliance; by its terms France undertook to succour the King of Sardinia in the event of an attack by Austria. The existence of this Alliance became public in January, 1859, and a few days later Cavour obtained a vote of 50,000,000 francs for the purpose of completing the Sardinian Armaments. Austria replied by concentrating troops in Lombardy; on the 29th April, 1859, Victor Emmanuel was given three days within which to disarm. The ultimatum was ignored: the Austrian Army forthwith crossed the Ticino, whilst a part of the French Army hurried across the Alps to succour the Piedmontese, and thus was commenced the Franco-Austrian War.

Prussia disliked the Franco-Italian Alliance and decided to intervene in order to prevent, if possible, the probable success of France. The question of intervention had been studied since the beginning of 1859, and the conclusion at which the Prince Regent of Prussia—in consultation with Schleinitz, his Minister for Foreign Affairs, and von Bonin, his War Minister—appears to have arrived was, that the surest method of bringing the French offensive in Italy to a halt would be by his undertaking an offensive movement against Northern France, in which the Belgian and Dutch Armies would be compelled to participate. The memoirs referred to disclose, not only, that von Moltke had received instructions to prepare a memorandum in relation to a plan of campaign against France, in which the co-operation, voluntary or compulsory, of Belgium and of Holland was to be borne in mind as an essential feature, but they also throw light on the fact that von Moltke received orders from von Bonin, in the presence of Schleinitz, to put the Belgian Army into motion and to march Prussian troops through Belgium. Even at that date,

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the object in view was the conquest by Prussia of Alsace and Lorraine: the means to reach this end was to be an offensive movement on Paris *viâ* Belgium, the objective in the operations naturally being the French Army.

This plan was not put into execution, for although the Prussians mobilized on the morrow of Magenta Napoleon III., not wishing to run the risks of a double war conducted simultaneously in two such widely separated fields, as those of Venetia and those of Belgium, hastened, after Solferino, to address to the Austrian Emperor proposals for an armistice, and subsequently peace was concluded at Villafranca on the 11th July, 1859, and the Prussian menace went to sleep for the time being.

VI. The Question of a German or Italian Offensive against France via Switzerland.

The sixth essay of this series—written in December, 1911—contains a discussion of the question: "What are the prospects of either a German or an Italian offensive move against France *viâ* Switzerland?" The discussion of the subject is subdivided into sections, the first of which deals with "The *Rôle* and Influence of France." In the preceding essays a considerable volume of evidence has been adduced by the author in support of his contention that, in the next war against France, Germany would attempt to turn the Lorraine front by means of a movement *viâ* Belgium. The German Active Army consisted of 25 Army Corps (including 1 Guards Corps, 3 Bavarian, 2 Saxon and 1 Wurtemberg Corps). Some writers have argued that the "Russian danger" would force Germany to hold from five to six of these corps—about one-fifth of the total—on her eastern frontier and it would only be the balance remaining which would be available for operations against France; other writers, on the other hand, held that Germany would at once concentrate her full strength against France.

In 1894, the General Staffs at St. Petersburg and Paris made a joint study of the military situation in Europe, and, as a consequence, a treaty was entered into between Russia and France—not till 1897, when President Faure visited Russia, was the term "Alliance" applied to the relations established under the treaty aforesaid, the terms of which remained secret. It is now, however, known that the Alliance was strictly defensive and reciprocal; Russia merely undertook that she would, in the event of an attack by Germany on France, stand by the latter, and *vice versâ*.

After the 1894 Treaty had been signed, Russia commenced to draw her troops southwards on to the German frontier, in particular into the province of Warsaw. This massing of Russian troops continued without cessation for a considerable time, until at one period half of the Russian Army—on its peace footing—was dis-

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tributed along the German and Austrian frontiers. Between Vilna and Warsaw were quartered 11 infantry divisions and 8 cavalry divisions—equivalent to 6 army corps at higher peace establishment. At the same time, Bielistock, Grodno and Warsaw were converted into veritable entrenched camps.

Matters remained approximately in this condition until the Potsdam meeting between the Czar and the Kaiser—November, 1910—when Germany agreed to give Russia *carte blanche* to do as she would in Persia, in return for concessions, etc., to be made to Germany by Russia in other directions. After the date of this meeting, Russia withdrew the troops which she had accumulated in Poland to a distance of several hundred kilometres—at least one day's journey from the German frontier—and these troops were, in 1911, quartered in the Government of Perm, at the foot of the Ural Mountains; she however still retained "troupes de couverture" on her western frontier.

It is hinted that the French Government, on this occasion, allowed itself to be taken by surprise; however this may be, it announced that the withdrawal of Russian troops from Poland was a matter of no practical importance. The author conjectures that since 1910 a secret treaty had existed between Germany and Russia; but he held the view that the latter would nevertheless remain true to her "Alliance" with France, assuming that this "Alliance" was a purely defensive one.

General Maitrot is of opinion that the time required for the mobilization of the Russian Army has always been underestimated. Those who allow one month as the period necessary for the mobilization make an error of 50 per cent.; the Guards Corps, which draws its reservists from every part of the Russian Empire, requires at least two months.

The Russian Field Army had, in the years preceding 1911, been generally considered to contain 2,500,000 men; it has been suggested that 700,000 men should have been deducted from the preceding figure, as representing the strength of the Territorial Army and the Reserves of the second category. The Russian Field Army in Europe, including the Reserves of the first and second categories, it is said, did not, at the period referred to, exceed 1,500,000 million men; and further that the Russian Army could not have, at this time, mobilized more than a quarter of a million men, of which a part only would have been available for employment in a region outside that in which it was recruited. Considerable improvements had been taking place in the organization, etc., of the Russian Army in recent years, and it was expected that at the end of 1911, Russia would be in a position to mobilize a field army of 3,000,000 men on her European frontiers within the space of one month from the breaking out of hostilities. Should Russia resolve then to intervene

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in a conflict between France and Germany, in support of the former country, it was probable that her army would have to reckon, without taking account of any force Germany might retain on her own eastern frontier, with :—

(*a*). An Austrian army of 15 army corps, containing approximately 800,000 men belonging to the first line troops.

(*b*). A Roumanian army of 4 army corps, 1 infantry division and 1 cavalry division ; say 200,000 highly-trained men.

That is to say, Austria and Roumania would probably put a total of approximately one million disciplined men into the field against any army Russia might concentrate on her own western confines.

It was hoped that the Alliance with Russia would provide France, in a struggle with Germany, with the support of the four army corps of the Vilna District for certain ; further, it was possible that circumstances might favour the entry of the Balkan Powers into the arena of hostilities, and more particularly Bulgaria and Servia, who presumably would, in such a case, take sides with Russia and France and thus, to some extent, paralyze the Austrian and Roumanian efforts in the eastern theatre of operations. The possible intervention of Bulgaria and Servia in support of Russia and France imposed on Germany the duty of providing for the contingency of a Russian advance from Poland on Berlin ; and it was thought that to bar the routes from Russia to her own capital Germany would be prompted to retain on her eastern frontier four army corps ; namely, the I. Army Corps at Königsberg, V. Army Corps at Posen, VI. Army Corps at Breslau and XX. Army Corps at Allenstein. There would thus remain 21 army corps of the German Active Army for an offensive campaign against France ; as already explained in an earlier essay, 17 of these army corps would probably be employed to execute the decisive onslaught *viâ* Belgium, whilst the remaining four army corps would undertake the duty of making a diversion on the Lorraine front. France would, as has been seen, have 22 army corps (active), including her colonial corps, with which to meet the German offensive directed against her land frontiers.

Opinions differed widely as to the part Italy might play, as an ally of Germany, in a European conflict. Some were convinced that Italy would never attack France, and therefore the latter need pay no heed to the question of the defence of the Alps. Others held the view that even if the Italians did attack France, the latter's Alpine troops, the forts and entrenched camps on the French frontier contiguous to Italy, the Territorial troops stationed in Savoy and the Dauphiny would prove sufficient to contain any offensive movement on the part of the Italians. Under these circumstances, whatever might be the intentions of Italian statesmen, France would be in a position, it was thought, to count on employing the whole of her Active Army on the Flanders and Lorraine fronts.

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Prudence dictated that the Italian menace should be considered as worthy of serious attention; General Maitrot was of opinion that the danger arising from the active participation of Italy, as an ally of Germany, would have the effect of withdrawing three French army corps from North and North-Eastern France—the 14th and 15th Corps, he felt, should be retained in the south-east for the defence of the Alps, whilst the 19th Corps should remain in Tunis to oppose a descent on this colony. The withdrawal of these three French corps would leave France 19 army corps with which to oppose the 21 German army corps likely to be employed in Belgium and on the Lorraine front; that is to say, the two principal adversaries would probably meet one another with forces about equal in strength.

For the German forces to triumph over the French arms and to triumph quickly—a war of extremely short duration on the western front being, in the opinion of many, essential for final success—it was necessary that the German offensive should rush through any resistance the French Army might be capable of putting up against it; it should like a torrential flood irresistibly carry everything before it, breaking up every obstacle which lay across its path. This requirement involved that the German armies in the western theatre should be concentrated against a single objective. An attempt on the part of the Germans to turn Belfort and the French right wing *viâ* Switzerland would, it was estimated, require at least three to four German army corps to be detached from their Central Force—required for the decisive stroke; the withdrawal of so large a force from the armies entrusted with the main effort would, it was thought, weaken them to such a degree as to compromise success in the only part of the western theatre of operations in which the chances were in favour of the German arms. It was therefore concluded that German armies would attempt no offensive movement across the Juras *viâ* Switzerland; if such an intention did exist to attack the French right wing, the task, it was thought, would be assigned to Italian troops. The Russian Alliance thus would prove of this value at least to France, namely that at the commencement of a Franco-German war, by causing four German army corps to be retained on the Russian frontier, the German forces available for the offensive in the western theatre would be so far reduced as to permit France to oppose the armies of her powerful eastern neighbour with French armies almost equal in numbers thereto.

The second section of this essay deals with "The *Rôle* and Influence of Italy." The part which Italy would play in a war of the Central European Powers against France and Russia had long been a matter for doubt. By some it was said, that Italy would never take up arms against a "sister nation." It was pointed out by them that France had shed her blood in the cause of Italian independence; nothing could repay her for the part she had played, not even the

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cession of Nice and Savoy. On the other hand the hard fact had to be faced that in 1870, only 11 years after Magenta and Solferino, when stricken France turned to Italy for help, although no treaty bound her to Prussia, the only assistance France received was that given by a small band of Garibaldians. The existence of the "Italia irredenta" movement was, until within a few weeks ago, at the bottom of much of the doubt which existed as to the side on which Italy would range her military strength. The desire to retake Nice and to possess Tunis caused her to be drawn into the Triplice against France; on the other hand, the desire, no less ardent, to repossess Trieste and the Trentino seemed likely to cause her to gravitate towards the Franco-Russian Alliance. General Maitrot summed up the situation in the following terms:—"Cruel enigma, of which Italy will find the solution, temporizing the while, she will not enter the field till as late a period as possible, and then she will do so on the side of the conqueror."

The Tripoli affair brought about a certain coolness between Italy and her two allies, and led to the publication of a violent article in the *Berliner Tageblatt* of 4th November, 1911. In this article occurs the following passage:—"In the case of a Franco-German war, the provinces of Piedmont and Lombardy, which are the two most powerful in the Kingdom, will very probably refuse to participate actively on behalf of Germany. Consequently, Germany must direct her sole attention, at the present moment, towards the consolidation of the Turkish Empire." The article enlarges on the failure of England and France to warn Germany of Italian acts of "brigandage," the intention to perpetrate which these Powers, it is alleged, had obtained knowledge in the preceding August. The *Berliner Tageblatt* complained that Italy had not been true to her alliance, but had treated Germany and Austria as negligible quantities. "Let us get rid of the Triplice," said the newspaper, "we have had enough of it on paper; Germany and Austria are sufficiently strong to hold their own against a European coalition; . . . Italy will, moreover, be found in the camp of our adversaries. . . . The friendship of Turkey is more precious and more important to us than that of Italy."

General Maitrot expresses the opinion that the article, from which the foregoing extracts have been made, showed a sudden access of anger which would quickly pass away. He felt that it would be advantageous for Germany to maintain the Triplice and that she would consequently pass a sponge over the record of the Tripoli affair. Italy stood, so to speak, at her Allies' gates and was thus a menacing danger, whilst Turkey was further away; Italy had not only an army but above all an increasing fleet, which acting in co-operation with the Austrian Navy—itself growing steadily—although it might not claim to be the mistress of the Mediterranean,

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nevertheless, was in a position, at least, to compel France to concentrate the whole of her sea power in the Middle Sea; on the other hand, the Turkish Navy was a negligible quantity. The foregoing considerations led General Maitrot to the conclusion that the Triple Alliance would give place to a Quadruple Alliance by Turkey becoming the fourth high contracting party to the new compact here foreshadowed.

In his study of the strategical situation on the south-eastern frontier of France the author has, with set purpose and deliberation, endeavoured to ascertain the conditions which would be most disadvantageous to France. In order to ascertain Italy's value to the Triplice it is necessary to examine briefly the extent of her land and sea forces. The Italian Army consists of 12 army corps of two infantry divisions each, except the corps with headquarters at Rome which has a third infantry division quartered in Sardinia. Six of the army corps are, in peace time, stationed in the basin of the Po, that is, in the provinces of Piedmont, Lombardy and Venice, as follows:—I. Army Corps at Turin, II. Army Corps at Alessandria, III. Army Corps at Milan, IV. Army Corps at Genoa, V. Army Corps at Verona, and VI. Army Corps at Bologna. The remaining six army corps occupy stations in the centre and south of Italy, as follows:—VII. Army Corps at Ancona, VIII. Army Corps at Florence, IX. Army Corps at Rome, X. Army Corps at Naples, XI. Army Corps at Bari and XII. Army Corps at Palermo.

The first line troops consist of 346 infantry battalions (including 22 battalions of Bersaglieri); 144 squadrons of cavalry; 207 field batteries of artillery, and possess, at war establishment, 400,000 men. The mobile militia (consisting of men on leave and the oldest class of reservists) is capable of furnishing another 200,000 combatants. The strength of the Italian Army capable of taking the field is 600,000 men, 1,600 guns and 180,000 horses. Behind this army, there would be the Territorial Militia, the strength of which is put at 2,000,000 men; it is however only organized on paper, and, therefore, considered by some to be an illusory force.

Italy had, since 1909, made considerable efforts to provide herself with a powerful navy. In 1911, the comparative strength of the Italian, Austrian and French Navies stood as follows:—

Class.	Italy.	Austria.	Total. Italy and Austria.	France.
Battleships ..	15	9	24	29
Cruisers ..	16	9	25	46

Comparing the strength of the above Powers by the numbers of Dreadnoughts (ships with displacement exceeding 17,000 tons) possessed by them at the date in question, Italy (with four such ships) and Austria (with two such ships) together could bring six Dreadnoughts only against France's eight. A consideration of the naval programmes of these three Powers led to the conclusion that,

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unless something abnormal should occur meanwhile, in the year 1920, France would possess 28 Dreadnoughts against a total of at least 13 contributed by Italy (with nine) and Austria (with at least four) together.

However a strong suspicion existed that Austria would exceed the construction shown in the naval programme made public by her, and it was expected that by 1920 she would possess 16 battleships (with a displacement of at least 25,000 tons), and that as Italy could not allow herself to be outstripped by her neighbour and ally, it was highly probable that the combined battleship squadrons of Italy and Austria would, in the year mentioned, consist of 32 Dreadnoughts and super-Dreadnoughts against the 28 ships of a similar tonnage possessed by France. Therefore, in view of the fact that both Italy and Austria were building cruisers also, which would bring up their combined strength in this type of ships to the number of the same type likely to be possessed by France in 1920, an increase in the French naval programme to meet the Italian and Austrian naval activities was strongly urged. General Maitrot expresses the opinion: "France will be forced to concentrate the whole of her fleet in the Mediterranean to deal with the united fleets of Austria and Italy; to the British Fleet, single handed, must be left the task of dealing with the German Navy." The "entente cordiale" had saved the situation, so far as France was concerned.

An article which appeared in the *Correspondant* of the 10th September, 1903, made public the plan of campaign which the General Staffs of the Triplice Powers are alleged to have concerted during the winter of 1900—1901. It was, in outline, as follows:—Three Italian Army Corps—the I., VII. and VIII.—were to advance into France *viâ* the French Alps; five Italian Army Corps—the III., IV., V., VI. and II.—were to cross the Bernese Alps with the object of taking up positions between Basle and Berne, their left covered by the Lakes of Bienne, Neuchâtel and Geneva. This Italian Army of 200,000 men would form an extension to the German left wing and would have assigned to it the task of turning Belfort and the French right by an offensive movement into France by the gaps of the Juras.

The III. and IV. Italian Army Corps would reach their positions by entering Switzerland *viâ* the St. Gothard route, the V. Italian Army Corps would follow the Splugen route, whilst the II. and VI. Army Corps would adopt that *viâ* the Simplon.

The remaining four Italian Army Corps—the IX., X., XI and XII.—not already disposed of would be held in readiness to make a descent on Algeria and Tunis and would form a kind of general reserve at the disposal of the Triplice Powers. Since it was first adumbrated the foregoing plan of campaign has undergone many modifications; the Tripoli affair certainly upset some of its details, since Italy will require to retain, for many years to come, a force of 50,000 men in her new African Colony, and this will require periodical

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drafts to replace wastage. Of the three offensive movements mentioned which Italy could make against France in the event of an European war, it was felt, that two only, the advance into France *viâ* the French Alps and the descent on Tunis, continued to constitute a serious menace and remained unaffected by the progress of events in Tripoli; the third movement involving, as it did, the violation of Switzerland by the Italian Army, in order to permit it to connect up with the German left wing, appeared to have become highly problematic.

The three moves open to the Italian Army referred to above are examined in detail. As regards the threatened move *viâ* the French Alps, the theatre of operations is thus described :—The Alps can be compared to an immense open fan, the pivot from which its ribs radiate being located at Turin and the curved edge of which is formed by the Mediterranean coast from Nice to Marseilles, thence along the waters of the Rhone as far as Lyons. Consequently all routes from France into Italy are convergent, conversely those from Italy into France are divergent. These routes are devoid of means of lateral inter-communication along the greater part of their length, by reason of the giant rock masses lying between them. Further, the mountain slopes fall precipitately towards the plains of Piedmont, whilst on the west the slopes descend by gentle gradients to the Rhone River—the frontier is but 40 km. (about 25 miles) from Turin, it is 150 km. (about 93 miles) from the Rhone. Whilst a French army could reach the banks of the Po in two days, it was expected that it would take the Italians eight days to march to the Rhone. All the conquerors who have crossed the Alps from the times of Hannibal to those of the great Napoleon have marched from west to east; on the other hand, every invasion recorded in history to have failed was attempted from east to west. To-day, every line of advance in these Alps is barred by defence works of importance; nevertheless, in view of the possibility that the three Italian Army Corps apparently intended to invade France might be reinforced by one or two additional Italian Army Corps drawn from the General Reserve and would probably be accompanied by artillery siege parks, as a mere matter of prudence, it was recommended that the defence of the Alps region should be confided to the 14th and 15th French Corps which, it was thought, would, in view of the existence of fortified areas in this region, be quite able to hold up any Italian army which might reasonably be expected to operate in this theatre. Provided always, that if unfortuitous circumstances should, by any means, give rise to a situation in the main theatre of operations whereby the French forces would be likely to find themselves in a position inferior to that of their principal adversary then, *coûte que coûte,* the 14th and 15th French Corps should be transported to the decisive region, to Lorraine and to Belgium. In this event it would be necessary to observe the six passages across

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the Alps, between France and Italy, namely those of the Little St. Bernard, of the Mont Cenis, of Mont Genèvre, of the Argentière, of Tenda, of the Corniche. Of these passages those of Tenda and of the Corniche are the most dangerous—as already stated they are all defended by *forts d'arrêt*, etc.—and it is the last mentioned which would require the most attention.

In order that the descent on Algeria and Tunis might be within the range of practical politics Italy must be mistress on the seas. The examination made of her naval strength shows that she had not attained that proud position in 1911, nevertheless the combined fleets of Italy and Austria were rapidly approaching in strength the French fleet, and it was felt that the threat of an Italian move against the French North African Colonies should, in consequence, be taken seriously, especially in view of the fact that the occupation of Tripoli had rendered the invasion of Tunis by Italian Colonial troops a feasible operation. Under these circumstances, it was urged, that it would be unwise to transport the 19th French Corps to Europe—an operation requiring at least 30 vessels.

To sum up then, it was expected that Italy would play a *rôle* in relation to the Triple Alliance analogous to that which, it was contemplated, Russia would play on behalf of the Entente Powers: Italy would cause the 14th, 15th and 19th French Corps to be detained in South-East France and North Africa, thus reducing by three army corps, the French armies available to meet the German offensive *viâ* Belgium and on the Lorraine front. Further, the Italian fleet in conjunction with that of Austria would paralyze the whole or part of the French Navy, by excluding the possibility of its employment in waters other than those of the Mediterranean.

In a third section to this essay is discussed "The *Rôle* and Influence of Switzerland," in view of the threatened Italian invasion *viâ* the Bernese Alps. As has been shown, it was thought that the danger of an Italian invasion of Switzerland was, even in 1911, no longer a matter requiring serious consideration. It was felt further, that Switzerland would see to it that her neutrality was respected by each one of the possible belligerents on her borders. Some there were who contested this view. They argued: the Swiss were pro-German in sympathy; that whereas in Belgium the Walloons and Flemish were about equal in number, on the other hand in Switzerland the German-Swiss population predominated, out of a total of 3,750,000 souls, 70 per cent. were of German origin, 22 per cent. of French origin and 7 per cent. of Italian—the Protestants had a large majority. Others estimated the Swiss character differently: they were of opinion that the Swiss might be pro-German in their sympathies, but they were the last people to permit their country to be invaded and thus to risk the loss of what they treasured most, their present independence. An eminent professor in an address, delivered at Zurich recently, is reported to have said:—"Yes, we

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are German by race, more German than many subjects of that great German Empire, even including the Prussians; but we are Swiss first and place the interests of our adopted country before those of any other land. We would prefer that the German-Swiss should impart an air of fiction to their origin for the purpose of preserving their nationality, rather than that we should see them become Germans; the Swiss remain Swiss for all time, whatever may be the tongue employed by them in order to communicate their thoughts."

General Maitrot advises no one indiscreetly even to hint the idea, in the hearing of officers of the Swiss Army, that this army would take refuge in the Oberland—a view expressed by some—and thus permit itself to disregard all the rules of duty, of honour, of patriotism. Intercourse with Swiss officers had revealed to him the fact that a firm intention existed of employing the army for the purpose of repelling any force which dared to invade their fatherland. Quotations are given from a Swiss newspaper and from the remarks made recently at Lausanne by Colonel Ed Secretan, a deputy of the National Assembly, which support the views expressed above.

Under the provisions of a Federal Law passed in April, 1907, the Swiss Army was given a new organization, in order to bring it more into accord with the requirements imposed by the geographical position of Switzerland and modern needs.

Briefly, the Federal Army consists of the *Élite*, men between 20 and 32 years of age; of the Landwehr, men over 32 and under 41 years of age; of the Landsturm, men over 40 and under 49 years of age. In the event of a war, the Landwehr maintains the *Élite* up to establishment, whilst the Landsturm plays a similar function towards the Landwehr. The recruits in the first year of service are trained for the following periods:—Cavalry for 90 days, artillery for 75 days, engineers and infantry 65 days. In subsequent years the men in the *Élite* attend annual trainings, the courses lasting, for artillery 14 days, for other arms 11 days. During the period of service in the Landwehr, all branches of the service, except cavalry, are trained once in four years, the course lasting 11 days. There are separate schools for those who aspire to the commissioned and non-commissioned ranks; special arrangements are made for the instruction of those destined for employment on the Staff.

Military service is personal and obligatory and those who will not submit themselves to military training and discipline are called upon to pay special taxes, until they reach their 40th birthday, according to fixed scales, the minimum tax being 6 francs per annum and the maximum 3,000 francs per annum. This tax produces 4,000,000 francs per annum; half of which is retained by the National Exchequer, the balance being paid over to the Canton authorities.

Under the reorganization scheme referred to, the four Swiss army corps maintained in former times were replaced by six infantry divisions of three brigades each; the smaller units being more supple

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and mobile could adapt themselves to the terrain more advantageously than the larger units. The third brigade of each division is the so-called "Mountain Brigade" and corresponds to the "Chasseurs Alpins" of the French Army. Although the army corps organization was abolished, nevertheless the staff of three of the former army corps was retained and is now employed, in peace time, to take part in the instruction of the army and to study military schemes. The organization provides for the mobilization of the "troupes de couverture" being completed in one day, whilst that of the first line troops (one-fifteenth of the population) can be effected in two days. The strength of the Swiss Army, on the war establishment is:—*Élite*, 145,000 men (including 5,000 cavalry); Landwehr, 70,000 men; Landsturm, 70,000 *armed* men. Therefore, the first two categories alone provide a field army of 215,000 men: an army, moreover, of great value, material as well as moral. This is the army then which Italy would have had to reckon with, if her five army corps had attempted to negotiate the Simplon, St. Gothard, and Splugen Passes—the only routes by means of which Switzerland can be entered from Italy—in accordance with the plan of campaign alleged to have been formulated in the winter of 1900—1901. It should not be forgotten that all these passes are fortified, the defences of the St. Gothard, being the most important, since under a Federal Law of 13th April, 1894, special provision was made to convert it into the "place du Gothard."

In the event of a war having taken place between France, on the one side, and Germany and Italy, on the other, political reasons would have deterred France from sending her troops into the provinces of Chablais and Faucigny, but should the Italians have violated Swiss neutrality, it was almost certain that France would have detached troops from her 14th Corps to the Dranse, in order to support the garrison occupying the defence works at St. Maurice.

It has been suggested that in the event of its having been found impossible to employ Italian troops in Switzerland, some other use could have been found for them. Many schemes having this object in view have, from time to time, claimed attention. In one of them, the question was considered of transporting five Italian army corps by rail to Munich *viâ* the Brenner Pass, with the object of ranging them along the Upper Rhine, in the neighbourhood of Basle, Huningue and Neuf Brisach. There are grave objections to the scheme; even supposing that all went well, it would require 30 days at least, from the declaration of war, to transport this Italian army to Upper Alsace; once there, their fusion with the German hosts would be closer than would have suited Italian tastes—involving, as it would the risk of the loss of their independence and the danger of their conversion into mere vassals and mercenaries in the pay of the German Emperor. The scheme had the further disadvantage of cutting the Italian armies into two distinct and widely separated

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parts; so that in the event of a decisive defeat of the combined Italian and Austrian Fleets by the French Navy, the 19th French Corps in Algeria would have been set free and could have joined up with the 14th and 15th French Corps in South-East France. These three French corps might have inflicted a serious defeat on the three Italian army corps detailed for operations in this region: should this have occurred, nothing could have prevented Italian soil from being invaded by French troops. However, since the foregoing scheme did not appeal to the Italian authorities, France did not find it necessary to preoccupy herself with the adoption of measures either to meet the possibility of the violation of Swiss neutrality or to counter an offensive movement across the Juras, having for its object the turning of the defences of Belfort and of the right wing of her army. Nevertheless, the retention of Italy in the Triplice kept alive both the threatened invasion *viâ* the Alps and the descent on Algeria; Italy was therefore capable of playing a sufficiently important *rôle* to induce Germany to do all in her power to bind her to the Triple Alliance.

Although Germany had been carrying out certain railway work on the Swiss frontier in recent years an examination into the nature of the works thus undertaken led to the conclusion that her activities in this direction could be explained on commercial grounds and there was nothing, as in the case of the railway works constructed on the Belgian frontier, which could be used as convincing evidence of an intention on the part of Germany *herself* to violate Swiss neutrality. Indeed, the contrary was the case.

In a fourth section, the conclusions arrived at by the author are set down in a summary form, as follows:—

1. The Russian menace will cause Germany to retain four army corps on the frontier of Poland—the I., V., VI. and XX. Army Corps.

2. The Italian menace will cause France to retain three corps in the south-east and in Algeria—the 14th, 15th and 19th Corps.

3. Consequently Germany will have only 21 army corps of the *Active* Army available for employment in the western theatre: France will be able to oppose this force with, at least, 19 corps.

4. France need not apprehend that any attack will be made on her either by German or by Italian troops pushed through Switzerland.

5. Germany and France will, consequently, range up, facing one another with armies approximately equal in numbers one to the other.

France, it was felt, could regard the eventuality of a collision with calm serenity and hope.

VII. Lorraine—its Defence.

The last essay of the series was written in 1911 and revised in 1913; it deals with the defence of Lorraine. In the opening paragraph it is stated: "The theatre of operations in the next Franco-

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German war will stretch from the North Sea to Switzerland." It was expected that Lorraine—from Longwy to Belfort—which formed the eastern frontier, on this front of 400 km. (about 250 miles), would be the region in which the first collision of French and German troops would take place. The Alsace-Lorraine frontier is divisible into three distinct portions by reason of the nature of the terrain comprised, as well as owing to the relative situation of the troops quartered in this region. In the north lies the portion comprised between the Belgian frontier and Nancy, this is the Woëvre region; in the centre is situated the zone between Nancy and the Donon, in it lies the gap of Charmes; to the south, extending from the Donon to the Ballon d'Alsace, are the Vosges Mountains.

Geographically the Woëvre is a plain lying between the Orne, the eastern bank of the Meuse and the Moselle. He who is master of the roads in this plain is master of the Woëvre. The Meuse Heights which border the Woëvre on its west are thickly wooded and fall precipitately towards the plain; their altitude varies from about 260 to 325 ft. These Heights are cut up by deep ravines, in which lie the routes leading from the Woëvre to the Meuse, and have a length of 100 km. (about 62 miles) from Commercy to Dun; at this latter place, they end abruptly. To the north of Dun, the Heights continue, but with somewhat less altitude than mentioned above, from Stenay to the Chiers; in the depression between the two portions of the Heights is situated the Dun-Stenay gap, through which pass the routes from the Metz-Thionville region leading direct to the district north of the Argonne, to the defiles of Grand-pré, of the Croix-aux-Bois, and of the Chêne-Populeux.

The width of the Meuse Heights vary considerably; at Commercy, it is scarcely more than 2½ km. (about 1½ miles), at Hattonchâtel it increases to 15 km. (about 9 miles), opposite to St. Mihiel it is 8 km. (about 5 miles), whilst at Verdun it is 9 km. (about 5½ miles). This peculiarity in the contour lines of the Heights affords some clue to the reasons which prompted the siting adopted for the forts erected thereon. Between Verdun and Toul there are five forts: Troyon, les Paroches, Camp des Romains (above St. Mihiel), Liouville and Gironville (on heights of Commercy). Now, the gorges of all these works face towards the Woëvre, that is to say, the forts face west, looking on to the Meuse; further the last two, those of Liouville and Gironville, occupying the eastern edge of the Heights have fronts facing both the Meuse and the Woëvre, towering above them at an altitude of about 260 ft. To understand this bizarre orientation of the forts it must be borne in mind that, when de Rivière planned the defences for this region, it was intended that the French concentration should take place on the line Chaumont-Neufchâteau, Gondrecourt, Bar-le-Duc, Revigny, Ste. Menehould. It was thought that, in order to cover a concentration zone behind this front, it

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would be sufficient to command the passages across the Meuse in such a manner as to render this river impassable to an enemy, by bringing all the bridges spanning it under the fire of defence works.

Where the Meuse Heights are sufficiently narrow, *e.g.* at Commercy, the forts (of Liouville and of Gironville) are sited so that fire may be brought to bear on the Woëvre, and, at the same time, also on to the Meuse, but in the other cases, where it was impossible to reconcile these two interests, the defence of the Woëvre was neglected in favour of what was then the more important object, the defence of the river line. However, since de Rivière's plans were first prepared, the French concentration zone has been pushed forward beyond the Meuse, as is readily indicated by the large numbers of military platforms provided along the railway from Lérouville to Sedan. It is no longer merely a question of denying the passages of the Meuse to the enemy, it is the Heights themselves and the routes across it, which must be fought for. Had the problem of the defence of this region been presented to de Rivière in its present-day aspect, there is little doubt but that he would have selected the eastern crest of the Heights for his forts.

The part of the frontier between Nancy and the Donon bears a totally different aspect. This region is very much cut up and is easily defensible. Instead of being traversed by routes following a direction which invites invasion, its rivers form a succession of parallel obstacles across the path of an invader.

In the southernmost portion of this frontier, the Vosges Mountains offer a very difficult country to an army advancing westward; there, small bodies of troops on the defensive are capable of engaging, with success, very much larger bodies advancing to the attack. Opposite to this region, the German garrisons are less numerous, and the German arrangements, therefore, do not create the same impression, as in the case of the region north of Lorraine, that any sudden overpowering attack is intended on this portion of the frontier. The foregoing examination led General Maitrot to the conclusion that the German offensive, in the Lorraine theatre, would be pushed through the Woëvre, on the front Nancy-Longwy. Elsewhere, the Germans would be content to take the offensive, without undue extension of their front, and they would, in particular attempt to seize all the "cols" of the Vosges by pushing forward the German garrisons nearest to them. The reasons which would prompt them to make their main effort on the French eastern frontier by the Woëvre lay in the fact that the routes across it lead direct on to the Meuse which they can reach either in the north by the Dun-Stenay gap, or further south, at some point between Verdun-Toul, by forcing one or other of the forts on the Meuse Heights. Once masters of the Meuse, the Germans would have turned the fortresses of Verdun and Toul and could seize the important railway from Lérouville to

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Sedan and thus obtain access to the Barrois and eventually to the Argonne. Last but not least, the possession of the Woëvre would enable the Germans to confiscate the resources of the rich Woëvre for the benefit of Metz, and thus to deprive the entrenched camps at Verdun and Toul of this source of supply.

In order that the Meuse may be rendered impassable, it is recommended that the old forts, Camp des Romains, Paroches and Troyon should be abandoned and that new works should be constructed at Montsec, above Hendicourt, at the point of Hattonchâtel, above Éparges, at Haudiomont. Similarly, north of Verdun, works should be constructed to cover the Meuse bridges between Cosenvoye and Stenay, namely near Damvillers, above Bréhéville, near St. Germain and at Stenay. The expenditure incurred would be money well spent and would afford immense security against the sudden aggression —" attaque brusquée "—which Germany was credited with having in contemplation. Small works for a moderate-sized garrison, such as those at Liège and Namur, it was suggested, alone were required —that is to say, works for a garrison of 50 infantrymen and 20 gunners. The cost of an individual work of this type, it was estimated, would not exceed 1,000,000 francs ; therefore the nine works, proposed for the protection of the line of the Meuse and the railways along this front, could be constructed at a cost not exceeding 9,000,000 francs, whilst the garrisons of these works would absorb a total of 700 men only. It was urged that if France could not at once spend this 9,000,000 francs on the defence of the Dun-Stenay gap, it was nevertheless imperative that, at least, the point of Hattonchâtel should be secured against sudden seizure by German troops. General Maitrot further urged the abandonment of Longwy, as it would, in his opinion, fall an easy trophy to the enemy at the commencement of a war, and that every effort should be made to improve and strengthen the defences of Montmédy. He expresses the opinion that from the point of view of railway communications, the situation south of the Woëvre is good for bringing up French reinforcements ; but to the north of Verdun there was no suitable line, and therefore the Rheims-Bazancourt-Challerange railway should be prolonged along the valley of the Andon (only 25 km. (about 15 miles) of track being required to be laid). The execution of this railway extension was held to be one requiring immediate and urgent attention.

Lorraine, it was true, would not be the decisive theatre of operations, but engagements of magnitude would be fought in this region. Consequently, it was advocated, everything should be done, *even the impossible*, in order to render success certain in this theatre. " Do not commence the next war by a Wissemburg, Worth, and Spicheren," is the final admonition contained in this volume.

W. A. J. O'MEARA.

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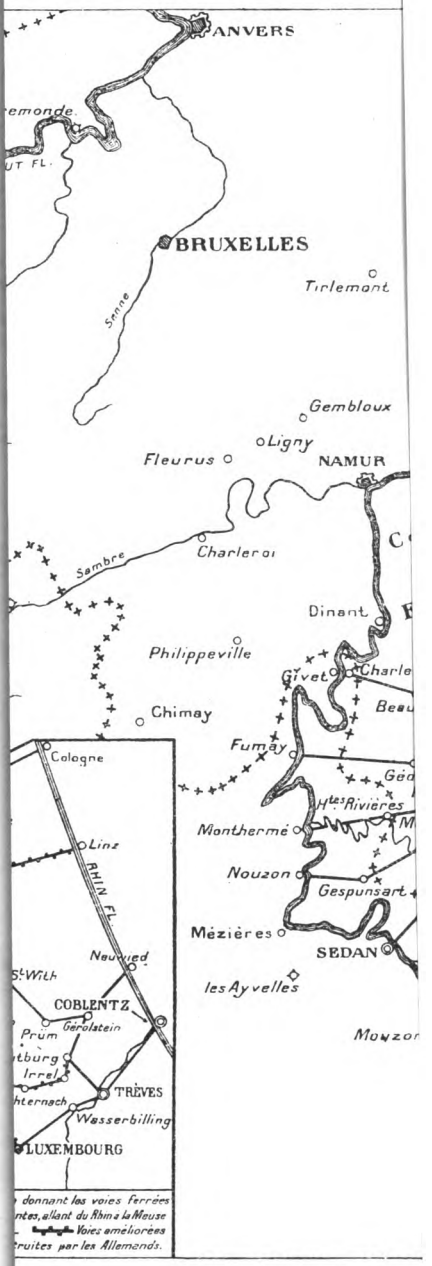

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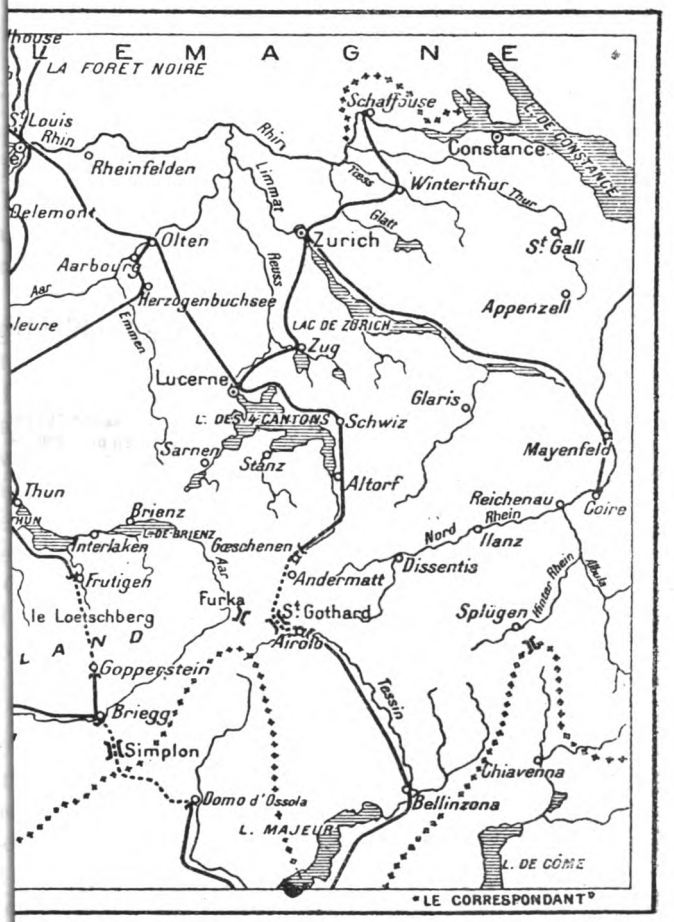

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La

SIEGES AND THE DEFENCE OF FORTIFIED PLACES BY THE BRITISH AND INDIAN ARMIES IN THE XIXth CENTURY.

(*Continued*).

By COLONEL SIR EDWARD T. THACKERAY, V.C., K.C.B. (LATE R.E.).

RELIEF OF LUCKNOW BY OUTRAM AND HAVELOCK, IN 1857—*Cont.*

Arrangements were in the meantime made and carried out for sending all the sick and wounded who could bear the journey to Allahabad. Reinforcements gradually arrived in small parties, the troops were allowed to rest after their fatigues, the regulations for the maintenance of public order were rigidly enforced, and the works at the intrenchment were pushed on.

The feeling entertained by Neill towards Havelock had never been very cordial. The two men were not formed to act together. Neill had chafed much under the inaction to which, since Havelock's arrival, he had been subjected, and he had greatly feared that in the advance which was to take place, he would again be left behind. His gratification then, may be imagined when, on the eve of Outram's arrival, Havelock informed him that the command of the right wing of the relieving force had been conferred upon him.

Sir James Outram arrived at Cawnpore on the 15th September. If there could be anything which would reconcile a successful soldier to supersession it would be to be superseded by such a man as Outram. He had been called the Bayard of the Indian Army. He was without fear and without reproach. Engaged in many contests, he never fought for himself—he fought always for the cause of those whom he believed to have been wronged. He was appalled neither by the power, the talent, the interest, of the side to which he was opposed.

Well might Sir Colin Campbell write these glowing words when announcing to the army this deed of real glory. Seldom, perhaps never, has it occurred to a Commander-in-Chief to publish and confirm such an order as the following one :—

" With such a reputation as Major-General Sir James Outram has won for himself, he can well afford to share glory and honour with others. But that does not lessen the value of the sacrifice he has made with such generosity in favour of Brig.-General Havelock, C.B., commanding the field force in Oudh.

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"Concurring, as the Commander-in-Chief does, in everything stated in the just eulogy of the latter by Sir James Outram, His Excellency takes this opportunity of publicly testifying to the army his admiration for an act of self-sacrifice and generosity, on a point which, of all others, is dear to a real soldier."

The force now at Havelock's disposal consisted of 3,179 men of all arms.* He divided it into three brigades:—two of infantry, the third of artillery. The 1st Brigade consisted of the 5th Fusiliers; the 84th Regiment, and, attached to it, two companies of the 64th; and the Madras Fusiliers. It was commanded by the gallant Neill.

The 2nd Brigade, composed of the 78th Highlanders; the 90th Light Infantry; and the Sikh Regiment of Ferozepore, was commanded by Brigadier Hamilton.

The 3rd Brigade included Capt. Maude's Battery, Capt. Olpherts' Battery, Major Eyre's Battery of heavy 18-pounders, the whole commanded by Major Cooper.

Besides these, there were 109 volunteers, and some 59 of the 12th Irregulars, believed to be faithful, under the command of Capt. L. Barrow. Major-General Outram was one of these volunteers. To defend Cawnpore during the advance on Lucknow, there remained the headquarters of the 64th Regiment, under the command of Colonel Wilson.

The whole of the reinforcements had reached Cawnpore by the morning of the 16th September to attempt the passage of the river when the bridge of boats was completed. On the afternoon of the 17th a party of the rebel cavalry and infantry, with three guns, came down to the opposite bank to reconnoitre. Their appearance was the signal for the withdrawal to the right bank of a party of Sikhs who had been sent across to cover the formation of the bridge, and a detachment of the rebel infantry crossed to an island and under cover of long grass opened fire on the men working at the bridge. A few round and shrapnel shot soon drove them away.

The bridge-head on the opposite side was covered by a detachment from the British force during the night, and on the 18th the bridge had so nearly approached completion that it was resolved to make arrangements at once to effect a successful passage. On the 18th no enemy was to be seen on the opposite bank. That morning four guns of Maude's Battery were crossed over to the island, and the 78th Highlanders and the 90th Light Infantry were marched to a position on the river bank, to be ready to take advantage of the completion of the bridge. Subsequently part of the

* The numerical strength of the component portions of the force was as follows:—Europeans: Infantry, 2,388; Volunteer Cavalry, 109; Artillery, 282. Natives: Sikh Infantry, 341; Native Irregular Cavalry, 59. Total, 3,179.

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90th and three guns of Maude's Battery crossed the river. At 11 o'clock the enemy brought down their heavy guns, and opened fire on the British, whose guns answered. The cannonade lasted three hours, ceasing almost as suddenly as it had begun.

On the 19th the bridge was ready. During the previous month frequent reconnaissances had been made by Capt. Crommelin* of the Engineers who had completed all the arrangements and collected the materials and superintended the construction of the bridge. As soon as the troops had crossed they were formed into contiguous quarter-columns, and the 84th being in the line of the enemy's fire were ordered to lie down. General Neill's Brigade was then ordered to take up a position on the right of the line, and to drive the enemy from some sandhills about 600 yards in advance which they occupied. Neill immediately moved forward his brigade and attacked the enemy. They made a firm resistance but were driven from their position. Whilst the infantry fight was going on William Olpherts† brought up a half-battery in splendid style, and silenced the enemy's guns. The enemy slowly retired, and the cavalry having followed them up to observe, the force piled arms, and awaited the arrival of the camp equipage. The next day was devoted to the crossing of Eyre's heavy guns, and they were brought into camp by noon. The arrangements for the advance were then complete. On the morning of the 21st the force started on its arduous task. On approaching the village of Mangalwúr, it became evident that the enemy was massed there in great strength. Havelock upon this took ground to the left, and deployed into line, having the volunteer cavalry on the extreme left. This had scarcely been accomplished before the enemy's guns, five in number, opened fire. They had one gun defended by a breastwork playing on the road. The three English batteries at once replied, whilst the infantry marched through the swamp to the high ground from which they could act on the rear of the rebels. Before they could reach the road behind the village the enemy had evacuated it. A rapid pursuit ensued and was most successful. The volunteer cavalry captured two guns, a set of colours, and an elephant, and killed about 120 men. This close pursuit drove the enemy helter-skelter through the village of Oonáo, no effort being made to defend it. The force had thus reached with but a skirmish the furthest point of Havelock's three brilliant inroads into Oudh.

The rain fell heavily next morning as Havelock's force left its night quarters, the 1st Brigade leading. After a march of 16 miles

* Afterwards Lieut.-General Crommelin, C.B., R.E.

† Regarding this officer, Lord Napier of Magdala once said "I have often seen Olpherts in action. but never without his deserving the Victoria Cross."

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they reached the village of Banni, which was a strong and defensible position. To reach it a force coming from Cawnpore had to cross the river Sái, here spanned by a long masonry bridge. The river was not fordable. Strong as was the position, the enemy neither used the advantages it offered them, nor opposed to our troops the smallest opposition. They even neglected to break down the bridge, and although they had constructed two batteries on the Lucknow side of it, had not the spirit to use them. Panic-stricken by Havelock's rapid advance, they abandoned the best chance they had of stopping him, and evacuated their strongest position before even it had been attacked. Banni was but 16 miles from Lucknow, and in the hope of giving information of his approach to the garrison of the Residency Havelock that evening fired a Royal salute. His men lay there for the night, their indignation aroused and their slumbers troubled by the constant sound of the booming of the cannon fire against their beleaguered countrymen.

By 8 o'clock on the 23rd they were on their way again, marching in column of subdivisions right in front. The rain had cleared off but it was very close and steamy, without a breath of wind. Since 6 o'clock that morning the booming of the cannon discharged against the Residency had ceased. This silence seemed to indicate that the enemy was massing his big guns to oppose the relieving force. For some time no enemy was visible, but as the British approached the Alambágh, infantry began to show themselves on their flanks, and it soon became apparent that the enemy was prepared to receive them at the walled garden. A party of cavalry was sent on to reconnoitre, and reported that the mutineers had six guns in position, that their left rested on the Alambágh, and their centre and right were drawn up behind a chain of hillocks.

Havelock then halted his force, changed the order of the column from right to left in front, and brought up the 78th Highlanders and Eyre's heavy guns. These changes having been effected, the British force moved on. No sooner, however, were they within range than the enemy's guns opened with round and grape shot; they must have studied the distance very carefully, for their first shot knocked over three officers of the 90th, all of whom subsequently died. The casualties among the men and camp followers were likewise considerable. But these losses did not check the advance. Whilst the 78th, the 90th, and the remainder of the 2nd Brigade pushed quickly on to gain the open ground on which it could deploy, Neill with the 1st Brigade took ground to the left, passing through deep ditches, through swamps, and over heavy ground.

Meanwhile Eyre's Battery on the road, and Olpherts' on the right, had opened out on the enemy, Maude's followed quickly. This fire had the effect of dispersing the rebel cavalry and cleared the way for the advance of our men. Neill now led his men over very

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heavy ground, and drove the rebels from several villages in succession. The key of the position, however, was the Alumbágh, and the upper-storied buildings adjacent to it. These the rebels defended with great resolution; but they could not withstand the assault made by the 5th Fusiliers. Advancing with the bayonet, the men of this splendid regiment cleared the houses and stormed the position. Of the guns the rebels had brought into action five were captured by the Volunteer Cavalry.

Having driven the enemy from the Alumbágh, the force advanced to within sight of the domes, the minarets, and the gardens of Lucknow. But the day's work had been hard, and the General prudently determined to halt for the night. Our men, however, had scarcely taken up the ground assigned to them and had halted, when the rebels who up to that time had been fleeing in desperate haste, suddenly stopped, brought up fresh guns, and opened a heavy fire on the regiments as they stood or lay in line.

Just at this time the rain came down in torrents. Havelock met this action of the enemy by drawing back his line of fire, throwing his right on the Alumbágh, and re-forming his left. The movement was a difficult one, as darkness had set in, and the road was obstructed with horses, elephants, bullocks, guns, and men. The 5th Fusiliers occupied the Alumbágh. The other regiments were more or less provided for, some occupying hamlets, some lying in the open. The Madras Fusiliers bivouacked in mud ankle deep; but they and the rest of the force "were as merry and jolly as possible."* The men had been greatly cheered by the news that reached them that day that Delhi had been captured.

The force halted throughout the day of the 24th. And the position was further changed so as to remove the men entirely from the range of the enemy's guns, which nevertheless continued their cannonade. The enemy's cavalry, likewise, creeping round to the rear, made an attempt on the baggage, but though they surprised and killed some ten or twelve of its defenders, they were eventually driven off. That night all the baggage of our men was stored in the Alumbágh, and a guard of 250 men was placed there. At last the day of trial dawned. General Havelock in consultation with Sir James Outram, had resolved to advance, not by the direct route to the Residency, but by another and more circuitous road skirting the Chárbágh Canal. Early on the morning of the 25th, the 1st Brigade headed by Maude's Battery, with two companies of the 5th Fusiliers leading, moved off in column of sections, right in front. They had advanced but a short distance when a tremendous fire opened upon them. From the Alumbágh to a house called the Yellow House, the advancing troops had to encounter

* MSS. Journal, kept at the time.

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a perfect storm of round and grape shot and a sharp musketry fire.

Vigorously pushing on, they approached the enclosure called the Chárbágh, and a village, both filled with the enemy. From there the musketry fire was very galling. Our men, however, dashed at the enemy and expelled them. The next point to be reached was the Chárbágh Bridge, the only opening left into Lucknow. The bridge was barred by an earthen parapet about 7 ft. high. On this parapet were mounted six guns, two of them 24-pounders. On approaching the position the force halted; Maude brought two guns to the front and opened fire, whilst Outram taking with him the 5th Fusiliers and the Sikhs, proceeded to drive the enemy from the enclosures on the right, with the view of bringing a reverse fire on the guns defending the bridge. The enemy had the advantage of numbers and position, and for some time the artillery duel raged with great fury. Maude had but two light guns and they were in the open. When the duel had lasted half an hour, it became evident that Maude could make no impression on the enemy. He had lost 21 men at the Yellow House, and others had fallen in front of the bridge.

Something had to be done. Under these circumstances, young Henry Havelock, always bold, daring and adventurous, imperilled his commission to carry out an idea which had flashed through his brain. Turning his horse's head, he galloped off in the direction of the post occupied by his father. After making the turn of the road, he halted, waited for three or four minutes, then galloping back to Neill, saluted him, and said, as if bringing an order from the General, whom he had not seen, "You are to charge the bridge, sir." Neill at once issued the order.

Arnold, of the Madras Fusiliers, dashed on to the bridge, with the advance of 25 men, Tytler and Havelock accompanying them mounted. Tytler was pierced through the groin and his horse killed. Every other man of the 25, except Havelock and a private named Jakes, was shot down by the enemy's six guns loaded with grape. Havelock, unable to pass the overlapping barrier, sat in his saddle, calling on the men to come on. Jakes stood by his side, loading and firing as fast as he could. A few seconds later the Madras Fusiliers swarmed over the parapet, and through the gap, and carried all before them. The entry into Lucknow was won. The 78th Highlanders of the 2nd Brigade followed and the captured guns were spiked.*

* For his gallant conduct on this occasion, Havelock was recommended by Sir James Outram for the Victoria Cross. He had previously received it for his conduct at Cawnpore. Maude also received the Cross for the persistent gallantry he displayed this day. "But for his nerve and coolness," wrote Outram, "the army could not have advanced." Private Jakes was killed later in the day.

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On the regiments of the 2nd Brigade closing up, the whole force advanced, but in pursuance of the resolution already referred to, instead of moving straight on through the city, it took a turn to the right at the bridge, and pushed on by a very bad and narrow road along the outskirts. The troops pressed along this road, subjected here to but little opposition. Two regiments were detached to cover the advance of the remaining brigades, as well as to protect the heavy guns, the dragging of which over a bad road was found both tedious and difficult.

This road gradually led into the outskirts of the city, and the men were forced to penetrate through narrow streets and lanes, every one of which seemed alive with the enemy's fire. Suddenly they found their progress barred by a narrow bridge over a nullah, with high banks on the opposite side. This bridge lay under the lee of the Kaiserbágh, partially commanded by the two guns posted there, and by the infantry occupying it. The infantry and the guns were forced to cross that bridge, and to cross it almost singly. The fire from the Kaiserbágh was tremendous. It happened, however, that a sheltered position was attainable on the other side, from which the enemy might be fired on with advantage. The troops as they crossed the bridge, took up this position and opening fire to some extent covered their comrades. But the ordeal was a terrible one, and many men fell at this point. Having passed this obstacle, the force re-united, and halted under cover of some deserted buildings near the Chuttar Munzil and Faratbaksh Palaces.

Darkness was now coming on. The rear guard, with the heavy guns, the wounded, and the baggage, was behind, exposed to the fury of the enemy. In a consultation with General Havelock, Sir James Outram proposed that the force should occupy the Chuttar Munzil for a few hours, to permit the junction with the rear guard. The proposition showed judgment and prudence, for the Chuttar Munzil was a strong position, easy to hold, and virtually communicated, by means of intervening palaces, with the Residency. Had the suggestion been adopted, the safety of the rear guard would have been assured, and the entrance into the Residency enclosure could have been effected with comparatively little loss. But General Havelock considered that the importance of letting the beleaguered garrison know that succour was at hand outweighed every other consideration. The troops, re-formed, accordingly pushed on. The houses in Khás Bazaar were thronged with the enemy. As the men approached the archway a tremendous fire opened upon them. Neill, who was leading them, passed through the archway, then, suddenly pulling up his horse, he directed his aide-de-camp, Gordon, to gallop back and recall a half-battery which had taken a wrong road. He remained there sitting on his horse, when a Sepoy, who had taken post on the arch, discharged his musket at him over the parapet

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on its top. The bullet entered his head behind the left ear and killed him. .Thus fell one of the bravest and most determined men in the British Army. He was a born warrior, very cool and very keen-sighted. In a word he was a noble type of the northern land that owned him. Though 57 years have elapsed since he fell, his memory still lives alike in India and in England.

Undeterred by the loss they had sustained, the British troops pressed on through the Khás Bazaar, fiercely assailed by a musketry fire. Emerging from this, the sounds of cheering from the Residency suddenly gladdened the ears of the Highlanders and their comrades. Others of the advancing force, who had forced their way through side streets, appeared on the scene almost immediately afterwards, and took up the cheers most vociferously. Well, indeed might their hearts swell within them. But they are not yet within the enclosure. The night was dark, and before our troops could enter, it was necessary to make a way for them and for the guns. The displacement of the impediments at the gate of the Baillie Guard which had so long resisted the enemy's assaults caused some delay. But at last they were removed, and many of the victorious troops entered. Then ensued a scene which cannot better be told than in the words of Capt. Wilson's diary :—

" At 4 p.m. report was made that some officers dressed in shooting coats and solah hats, a regiment of Europeans in blue pantaloons and shirts, and a bullock battery were seen near Mr. Martin's house, and the Moti Mahal. At 5 p.m. volleys of musketry, rapidly growing louder, were heard in the city. But soon the firing of a Minié ball over our heads gave notice of the still nearer approach of our friends, of whom as yet little or nothing had been seen, though the enemy had been seen firing heavily on them from the roofs of the houses. Five minutes later, and our troops were seen fighting their way through one of the principal streets ; and though men fell at almost every step, yet nothing could withstand the headlong gallantry of our reinforcements. Once fairly *seen* all our doubts and fears regarding them were ended : and then the garrison's long pent-up feelings of anxiety and suspense burst forth in a succession of deafening cheers. From every pit, trench, and battery, from behind the sandbags piled on shattered houses, from every post still held by a few gallant spirits, rose cheer on cheer. Even from the hospital many of the wounded crawled forth to join in that glad shout of welcome to those who had so bravely come to our assistance. It was a moment never to be forgotten.

" Soon all the rear-guard and heavy guns were inside our position ; and then ensued a scene which baffles description. For 87 days the Lucknow garrison had lived in utter ignorance of all that had taken place outside. Wives who had long mourned their husbands as dead were restored to them. Others,

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fondly looking forward to glad meetings with those near and dear to them, now for the first time learned that they were alone. On all sides eager inquiries for relations and friends were made. Alas! in too many instances the answer was a painful one. Such an operation as the relief of Lucknow by so small a force could not indeed be effected save at a heavy sacrifice of life. The actual loss of the relieving force up to the 25th September inclusive, in killed and wounded, amounted to 564 officers and men. This does not include the casualties sustained by the rear guard up to the morning of the 27th amounting to 61 killed, and 77 missing. As the missing were sick or wounded men, who had been intercepted or slain the number of killed of the rear guard may be counted as 138. This would raise the entire losses of the relief operation to 702 officers and men. Amongst the former was Major Cooper, commanding the Artillery Brigade. By his death the command of that brigade devolved upon Major Eyre."

The force which had with such daring and persistent bravery reached the beleaguered Residency discovered in a few hours that they had reached that spot only to increase the number of the garrison. Means of transport for the combined force were wanting, and the force was not strong enough to escort the ladies and children to Cawnpore. The result of the successful advance on Lucknow was that more mouths required to be fed—more lodgment had become necessary for the garrison. But to meet and overcome such difficulties is one of the natural tasks of a real man. How Sir James Outram who had resumed command on the 26th met and conquered them will presently be described.

(*To be continued*).

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REVIEW.

LES ARMÉES FRANÇAISE ET ALLEMANDE—LEUR ARTILLERIE, LEUR FUSIL, LEUR MATÉRIEL.

By GENERAL MAITROT.—(Berger-Levrault, Paris: Rue Des Beaux-Arts. December, 1914).

AN earlier edition of this little volume was published in 1912; the present edition was revised and brought up to date in January, 1914. The volume contains short descriptions of the weapons in the hands of the French and German Armies; a comparison of their relative merits; short dissertations on the employment of airships and aeroplanes in connection with military operations; and suggestions regarding the distribution, etc., of meat rations to the French Army whilst on active service.

The Rifle.—The author states that when the ballistic qualities of the Lebel rifle—introduced into the French Army in 1886—and the murderous effects of its fire became known, grave disquietude prevailed on the eastern bank of the Rhine. This rifle was so superior to any previously in use that no doubt existed as to how immense was the advantage which the possession of this weapon gave France. However, since then other nations have provided themselves with rifles equal in value to the Lebel.

The rifle in the hands of the German soldier at the commencement of the present war was a modified design (pattern 1898) of the Mauser (pattern 1888); the cartridges can be inserted into its breech-piece singly, or its magazine, capable of holding five cartridges, can be charged from a strip pattern cartridge-holder. The old pattern bullet consisted of lead coated with a nickel envelope; it weighed 14·7 grammes. The old pattern cartridges propelled the bullet from this rifle with an initial velocity of 600 metres per sec., substantially the same as that obtained with the cartridges first in use with the Lebel. In 1903, the Germans adopted a new cartridge; an improved propellant was used and fired the so-called S type of bullet, consisting of lead with a soft-steel pointed nose; this bullet weighed 10 grammes and was projected from the rifle with an initial velocity of 800 metres per sec.

The Lebel rifle is provided with a tubular magazine constructed to carry eight cartridges; so that the French soldier can fire nine rounds consecutively without having to resort to hand loading. However, once his magazine is emptied it takes so long to refill that it is doubtful whether in the stress of an action the soldier will be able to recharge the magazine, consequently he may find it more advantageous to load and fire each round singly. Although the magazine of the German

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rifle can only contain five rounds, on the other hand, it can be refilled in practically as short a time as it takes to place a single round in the breech. Recently a new pattern cartridge has been introduced into the French Army and fires the so-called D bullet, which is similar to the German S bullet; the D bullet leaves the rifle with an initial velocity of 700 metres per sec., but being heavier than the S bullet it is still a dangerous projectile at ranges at which the German bullet is ineffective.

The German rifle is lighter than the French one, it is more easily loaded, it is provided with a simpler mechanism, but its ballistic properties are somewhat inferior to the Lebel.

In 1900, the question of rearming the French infantry was very seriously discussed; the weak points of the Lebel were:—

(*a*). The length of time taken to load the magazine.

(*b*). Excessively rapid deterioration of the barrel with use.

However, it was found that the defects were easily removable, and by January, 1914, necessary alterations had been made to 3,000,000 rifles in the hands of French troops, at a cost of 3,000,000 francs; rearmament could not have been effected in less than two years and would have involved an expenditure of 800,000,000 francs.

Machine Guns.—The French machine gun is that known as the model de Puteaux or de Saint Étienne, and is carried on pack animals; it fires the Lebel rifle cartridge, being fed from a metal band. It was intended that each infantry battalion should have one machine-gun section (of two guns); an infantry regiment should therefore have three machine-gun sections, however it was only those regiments which were stationed on the frontier that had been supplied with this number of sections, regiments stationed in the interior possessed only two machine-gun sections. One machine-gun section was allotted to each cavalry brigade; the author considers this insufficient and recommends an increase to one section per cavalry regiment. The guns, in the latter case, are mounted on small gun-carriages drawn by a team of four horses; the gun detachments are mounted on horses.

The German machine gun is of the Maxim pattern; it fires the rifle cartridge, fed into it from a canvas band. The barrel is water-cooled; this is not the case with the French machine gun. Six machine guns form a company; the guns are mounted on carriages drawn by a pair of horses. One machine-gun company was to have been allotted to each infantry regiment; 112 companies, *i.e.* one per brigade only had been formed when this volume went to press. The establishment of a machine-gun company is 4 officers, 83 N.C.O.'s and men, 26 horses, 6 guns, 3 ammunition wagons. The officers are mounted, the gun detachments dismounted.

Machine-gun companies allotted to cavalry regiments have also 6 guns; the detachments in this case are carried on wagons.

It is claimed that the French organization is more supple than the German one; pack animals can go almost anywhere and can be stealthily led into localities which are impenetrable to wagons. Considered as mere pieces of mechanism, the French and German weapons possess an equal value; in each case the gun is capable of firing from 200 to 600

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rounds per minute. The Germans put great faith in their machine guns and handle them adroitly.

Artillery.—It was early recognized that one of the causes which contributed to the German success in 1870, was the superiority of their field artillery over that of the French; since the conclusion of the last Franco-German War, the French have made great progress in matters of field artillery.

The author deals with this branch of the subject under the three heads:—Light Field Guns; Heavy Field Guns; Stationary and Siege Guns. He applies the term light field guns to those pieces which, by reason of their moderate weight, can be drawn by 6 horses over almost any kind of country ordinarily met with and at any pace at which troops are accustomed to manœuvre; it applies to the French "75" gun and the German "77" gun and 105-mm. howitzer—the latter being scarcely heavier than the "77" gun.

A French Army Corps is provided with 120 light field guns. Since October, 1913, a German Army Corps has been provided with 144 light field guns—54 "77" guns and 18 105-mm. howitzers per infantry division—and in addition it possesses some heavy pieces.

The superiority of the French "75" gun over the German "77" gun is admitted by the Germans. The "75" gun however possesses three defects:—(*a*). Its horizontal field of fire is too limited, so that moving objectives easily escape. (*b*). Its weight is considerable; the gun harnessed, with three gunners on the limber, weighs 2,125 kg. (nearly 420 cwt.). (*c*). Its vertical field of fire is still more limited than its horizontal field; it cannot therefore be used against aircraft.

Colonel Deport has invented a new gun known as the "canon à grand champs de tir"; it possesses a horizontal field of fire covering a sector of from 45 to 50 degrees, and a vertical field of fire represented by an arc of from 50 to 70 degrees. It can not only change its objective instantly but it can also turn its fire against aerial targets without difficulty. It has the same calibre as the "75" gun, but it is lighter than it, by some 100 kg. The French Artillery Direction were not able to adopt Deport's gun—mainly on practical grounds connected with the training of the reservist gunners; however, the Italian Government was permitted to make use of this invention. The author has sharp criticism to offer regarding the policy adopted, which allowed a French invention to pass into the possession of an adherent of the Triple Alliance.

The German 105-mm. howitzer is the most modern piece of artillery in their possession; it fires at least five to six rounds per minute and has a range of from 6,000 to 7,000 metres. Its projectile is in the nature of a shrapnel weighing 14 kg. (about 31 lbs.). The Germans have great confidence in this howitzer and, late in 1913, doubled the number of pieces allotted to an army corps, each of which now has two brigades of these howitzers. These pieces, in the author's opinion, far outmatch the French "75" guns which, in spite of their shields, will not be able to stand up to these howitzers.

The French possess no howitzers; designs were got out for one but the matter was dropped suddenly owing to a discovery which enabled the "75" gun to be used for high-angle fire without altering the charge.

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At the beginning of the war the only heavy field artillery possessed by the French was the Rimailho gun. The calibre of this gun is 15·5 cm.; it is capable of throwing a 40-kg. (about 90-lb.) projectile to a distance of 6,500 metres and requires two vehicles for its transport. The Rimailho gun was first experimented with at Chalons in 1905 or 1906 and, although great secrecy was observed at the trials, the Germans somehow procured photographs and a description of the gun.

The German heavy field artillery consists of the 15-cm. howitzer, 10·5-cm. gun and 21-cm. mortar. These pieces are too heavy to be moved rapidly over difficult ground. The 15-cm. howitzer is not provided with shields; it can fire two to three rounds per minute and throws a 40-kg. (about 90-lb.) projectile to a distance of 7,400 metres (some say 6,500 metres). The projectile is very murderous and breaks up into some 700 fragments which, it is claimed, no gun shield can resist. Sixteen of these heavy howitzers have been allotted to each army corps, in addition to the 144 light field guns already mentioned. It is proposed to give each army corps 10·5-cm. guns as well; these guns are capable of throwing a 18-kg. (about 40-lb.) projectile to a distance of 10,500 metres.

The Germans have organized mortar battalions consisting of two batteries, each battery being armed with four 21-cm. mortars. This piece is capable of throwing a 119-kg. (about 260-lb.) projectile to a distance of 8,500 metres. It is intended that these battalions shall accompany the heavy artillery on the march, for use against "forts d'arrêts."

It was expected that the Germans would bring their heavy artillery into action at the opening phase of a battle with the object of crushing the French "75" and Rimailho guns. As soon as they had effected this purpose they would be in a position to turn their light artillery against the French infantry without fear of molestation, owing to the prior destruction of their enemy's artillery. The author urges that the French Army should be provided, without delay, with a sufficient number of pieces of equal power to the German heavy artillery. The cost of giving effect to the proposal may be considerable, but it cannot, he thinks, prove so burdensome as would the indemnity of 25 milliards of francs which the Germans would probably demand in the event of their armies proving victorious in the next war.

In the matter of fortress and siege artillery, the German Army possesses a number of light siege parks; these are kept up in peace time and have allotted to them pieces such as the 13-cm. gun and the 28-cm. mortar; these pieces are heavier than those forming the heavy units referred to. The light siege parks are intended to march with the field army; the Germans have realized that from the moment French territory is entered their troops will have to deal, not only with "forts d'arrêts," but also with powerfully constructed works enclosing fortified centres.

The 13-cm. gun and the 28-cm. mortar are the two most powerful weapons in the hands of the German artillery. The 13-cm. gun is capable of throwing a 30-kg. (about 66-lb.) projectile to a distance of 14,500 metres. Little is known about the 28-cm. mortar; it is reported to be capable of effecting terrible execution.

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The most powerful siege gun in possession of the French Army is the long 15·5-cm. gun which is capable of firing a 40-kg. (about 90-lb.) projectile to a distance of 9,000 metres. The French artillery still had two obsolete mortars on hand: the 22-cm. mortar firing a 98-kg. (about 210-lb.) projectile, maximum range 5,400 metres; and the 27-cm. mortar firing a 228-kg. (about 500-lb.) projectile, maximum range 7,000 metres.

The author considers that the Germans possess a considerable superiority over the French in the matter of siege guns.

Ammunition Supply.—The author examines the recorded experiences of the Manchurian and Balkan Campaigns relating to the expenditure of ammunition. In calculating ammunition requirements, the points which must be taken into account, in addition to tactical considerations, are the moral factors relating to the belligerent forces, such as their energy, tenacity, courage, standard of instruction and training.

It is suggested that the experience of the Serbo-Bulgarian War should be employed as the basis for estimating the requirements for the next Franco-German; due allowance should however be made to meet the fact that the Germans will prove more redoubtable than did even the Bulgars against the Serbs. The consumption of ammunition is likely to be double or even treble that used by the Serbs; therefore as their guns fired on an average 1,000 rounds per gun the French are recommended to provide, *in peace time*, 2,000 to 3,000 rounds per gun in the service.

Means of Transport.—The question which, last year, required most serious consideration in France was that relating to the transport of ammunition from railhead to the refilling points. The author examines, in this chapter, the situation from the point of view of the number of motor-vehicles in France which might be made utilizable for the transport of ammunition and supplies. The Minister for War last year took steps to create a nucleus of military motor vehicles, and, on the 1st February, 1914, two military automobile centres were formed in France. The number of motor vehicles in the possession of the military authorities were, however, insufficient to meet the whole of the needs of the army, it is in consequence urged in this chapter that steps should be taken early to make the necessary alterations to ordinary trade motor vehicles, of which there were 100,000 in France in 1914, to adapt them for military use. It is stated that Germany was already well provided with military motor vehicles, and that Russia was also ahead of France in this matter; 300 ammunition motor wagons having been purchased for the Russian Army in 1912 and 1913, whilst a further credit was voted in 1914 to add another 400 to the foregoing number.

The question of motor spirit and petrol is also dealt with, and as it appeared improbable that horses could be obtained in sufficient numbers to replace the services performed by motor vehicles, in the event of the foreign sources of petrol and motor-spirit supply on which France relies being cut off, the author strongly urges that early steps should be taken to accumulate and store these commodities in France in sufficient quantities to meet the probable requirements of the Army in the case of a European war.

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Dirigibles and Aeroplanes.—France has put her faith in aeroplanes alone and neglected dirigibles; this is considered to have been a mistake on her part. Dirigibles and aeroplanes are held to be complementary to one another; the use of one does not exclude the use of the other. Dirigibles exist for the purpose of undertaking strategical reconnaissances, in which case great speed is less a desideratum than great power of remaining in the air for a considerable time; aeroplanes, on the other hand, are required for rapid tactical reconnaissances of the field of battle; they are the engine of discovery and observation on the battlefield. Dirigibles are practically safe at an altitude greater than 1,200 metres against the fire of both the ordinary field gun and of rifles, but where they can be brought under the fire of special anti-aircraft artillery they are not safe at altitudes of less than 2,000 metres. Dirigibles are classified as vedettes, scouts and cruisers in accordance with their special functions; brief particulars relating to each of these classes of airship are given.

Germany had, in 1914, an aerial fleet of 18 dirigibles, 6 being Zeppelins, capacity 18,000 to 19,000 cubic metres and capable of travelling at a speed of 58 km. (about 36 miles) per hour; France possessed 15 dirigibles, one alone had a capacity exceeding 10,000 cubic metres, the average speed of these French airships was 48 km. (about 30 miles) per hour. In the matter of aeroplanes, it is claimed, France had an advantage in numbers of machines and in the skill, science and boldness of her aviators. Aeroplanes, when in flight, are less vulnerable than dirigibles from artillery and rifle fire owing to the smaller target they offer, as well as to their higher speed of travelling.

Comparison.—The French and German Armies are compared. The *morale* of the German Army is admitted to be high; there was not an officer or soldier who, before August, 1914, was not confidently certain that in a war between France and their country, success would be on their side. The *morale* of the French soldier was as good as that of the German soldier, but with this difference: the former did not hold his possible adversary in the same contempt that the latter held the French soldier. Neither army will enter the fray with any practical experience of "la grande guerre"; however, many French soldiers have taken part, in recent years, in Colonial warfare.

The qualities of the two armies are summed up thus:—The French Army possesses resolution and elasticity in a high degree. The German Army is grand, majestic, solemn, but sad, all initiative, all individuality have been abolished from its ranks.

Meat Supply to Armies in the Field.—The question is discussed under four heads. Under the first of these heads, the "solution of to-day and to-morrow" is discussed. The author recommends that abattoirs, one per army corps, be constituted under central control at points from 120 to 150 km. (about 75 to 95 miles)—*i.e.* about six hours' journey by motor vehicle—in rear of the army. A park should be attached to each abattoir to contain a herd of 200 head of cattle, thus providing four days' meat rations for an army corps; one-fourth of this number of animals would therefore be slaughtered and replaced daily. The carcasses would have to be conveyed daily to refilling points by motor

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transport. This arrangement, it is recognized, is not perfect; among its disadvantages are:—

1. The large *personnel* required to attend to the abattoirs.

2. The moving of the abattoirs would be a serious operation, not to be carried out in a hurry.

3. The cost of the meat ration would be much enhanced.

4. The risk would be involved of a loss of the whole of the cattle in a park should a single animal be introduced into it carrying the germs of an epizootic disease.

Under the second head the "other solutions possible" are dealt with. The chief difficulty in the case of the solution proposed under the preceding head is stated to be that connected with the animals herded in the parks whilst awaiting slaughter. This difficulty, it is suggested, might be partially overcome by reducing the number of beasts in the parks; this could be rendered possible by substituting for a part of the fresh-meat ration some kind of preserved meat.

The advantages and disadvantages, from the point of view of French military requirements, of (*a*) salted meat, (*b*) frozen meat and (*c*) chilled meat, as substitutes for a part of the fresh-meat ration, are discussed and the conclusion is reached that the use of chilled meat would offer the best solution, but it cannot be utilized in France owing to the fact, first that suitable storage accommodation for the purpose does not exist in the country, and secondly that there would not be a sufficient number of suitable vehicles for its transport from the French ports to the troops in the fighting line.

Under the third section a discovery of M. Ch. Tellier, the so-called "dehydrated" meat, is described, and it is urged that the adoption of this kind of preserved meat for army rations would remove all present difficulties. Its price is low and it possesses the advantage of retaining its freshness for three months.

Under the fourth head is discussed the question of the amount of meat which should be included in the soldier's daily ration; information is given on the subject of the average quantity of meat per head consumed in different countries.

W. A. J. O'MEARA.

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IMPROVEMENTS IN CAMP EQUIPMENT.

By 2ND LIEUT. E. MCKAIG, A.M.I.C.E., R.E. (T.).

THE conditions underlying the construction and equipment of summer training camps to-day are very different to those of a year ago.

In pre-war times, providing the site was a dry one and an adequate water supply available, all was in order to move in and pitch the tents, and the training proceeded. Sanitary and hygienic questions were not so pressing and important owing to the fact that the camp would be at an end in 14 or at the most 28 days. Now, all camps become more or less standing stations and require to remain sanitary and habitable for four to six months or even longer.

After the water supply probably the most important item of equipment to the health of the troops is the latrine. It may be described as a necessary evil, but necessary it remains, the evil can be somewhat reduced.

In most sites the usual hut latrine has many objections, chiefly its exposure to the sun's rays and consequent fly nuisance, and secondly in the vicinity of dwellings its extreme unsightliness; these objections have been got rid of and at the same time other advantages obtained, viz., cheaper construction by making them as shown in *Figs.* 1 and 2, a semi-subterranean structure.

Latrines on these lines have been constructed for camps in ———; some in service for two months have maintained all that was claimed of them, and are highly satisfactory, and in materials more economical than the usual hut. It has been the practice to use on floors of latrines, boards with cross battens as bucket stands; these can be replaced with advantage by sanitary concrete slabs (see *Fig.* 4) with little or no increase of cost. The slabs being made an article of store, weighing about 60 to 70 lbs., could also be used as paving to standpipes (see *Fig.* 5), and night latrine bucket stands, etc. (*Fig.* 6). The V grooves assist in easy washing and disinfecting. They could be made on the site by unskilled labour, but preferably manufactured and delivered to the site by a civilian contractor, and once made becoming permanent.

The main difficulty in field latrines according to medical officers appears to be the fouling of the ground and difficulty in cleansing and disinfecting, and the slab is a simple expedient to minimize this.

The horse lines are another difficulty. In a camp of any duration

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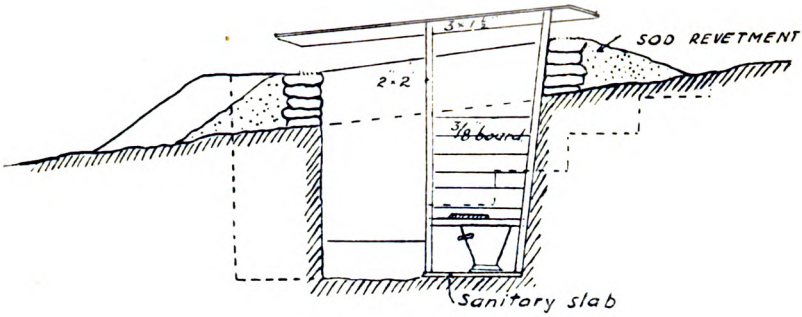

FIG. 1.—*Section A.A.*

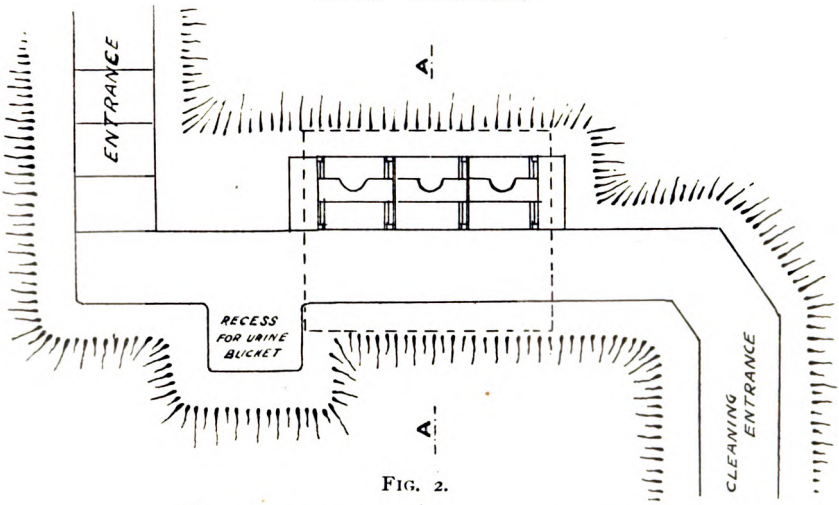

FIG. 2.

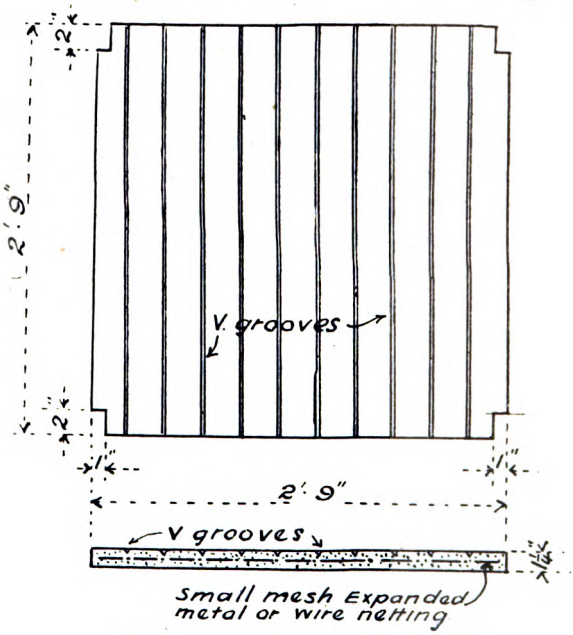

FIG. 4.—*P.C. Concrete Sanitary Slab.*

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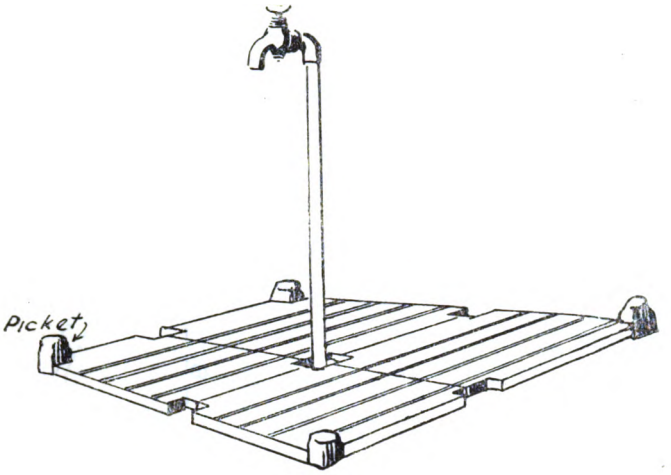

FIG. 5.

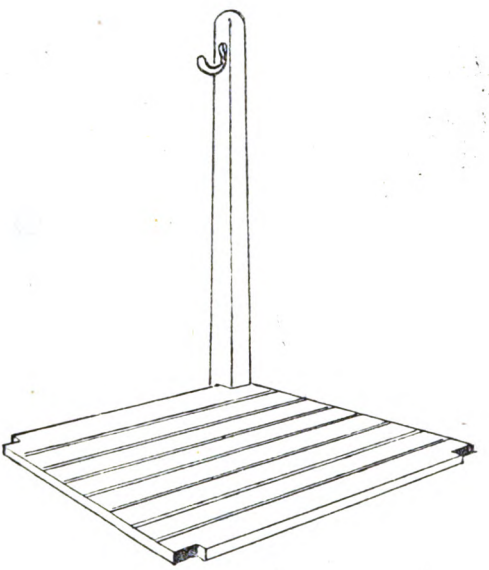

FIG. 6.

in bad weather, it becomes necessary to frequently move these or the health of the animals becomes impaired. *Figs.* 7 and 8 make a good arrangement. Here the cost is increased but not in proportion to the advantages, when the health and comfort of the horses is considered.

Fig. 9.—*Portable Saddlery and Harness Stand.*—For reasons of economy and expedition it is suggested that all the parts of the foregoing should be standardized and made articles of store, and if made at a depôt a great deal of the waste of material that cannot be avoided when camp equipment is arranged at the site would be

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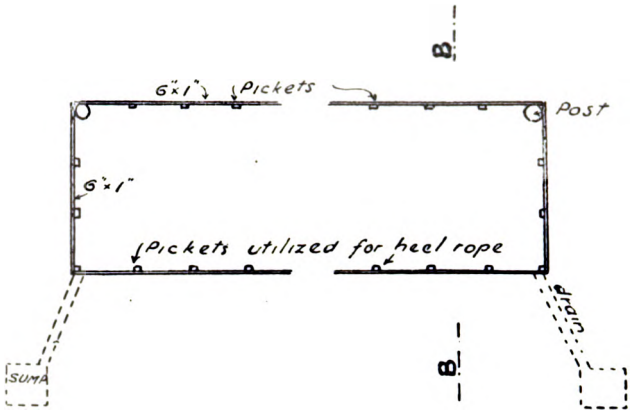

FIG. 7.

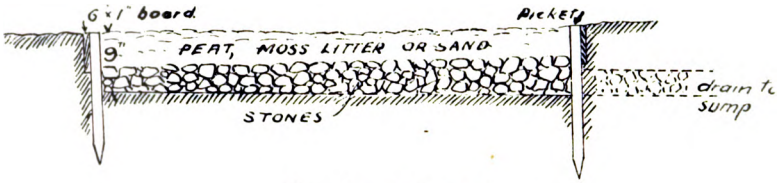

FIG. 8.—*Section B.B.*

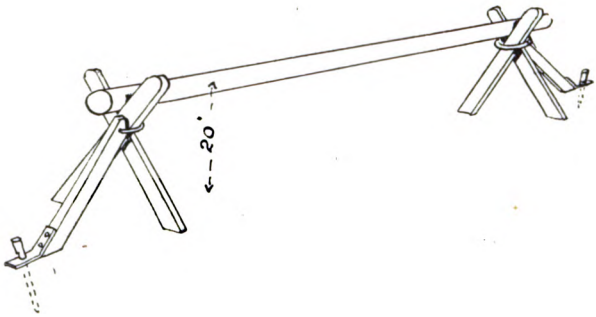

FIG. 9.

prevented and materials usually regarded as expendable would become "return to store." In short the complete equipment of a camp would become permanent and portable, more hygienic and economical.

Without exception all the foregoing could be made during training of Divisional R.E. sappers, and could be made to constitute their trade tests to a considerable extent. The figures accompanying this article are type sketches only, and not intended to be working drawings and subject to amendments and improvement.

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SIEGES AND THE DEFENCE OF FORTIFIED PLACES BY THE BRITISH AND INDIAN ARMIES IN THE XIXth CENTURY.

(*Continued*).

By COLONEL SIR EDWARD T. THACKERAY, V.C., K.C.B. (LATE R.E.).

THE SECOND RELIEF OF LUCKNOW.

The Commander-in-Chief, General Sir Colin Campbell, reached Cawnpore on the 3rd November, 1857, with the resolution to relieve Lucknow before doing anything else, and he had previously made all his arrangements for an advance on Lucknow. Sir Hope Grant's column which had left Delhi after the capture of that city, had reached Cawnpore on the 26th October, where it was increased to an effective strength of 5,500. Something arrived daily in the way of provisions and carriage, for the certainty of having to carry back with him the women and children had not been lost sight of by the Commander-in-Chief.

Sir Colin Campbell joined Hope Grant on the 9th. The interval, from the 3rd to the 9th, had been spent by the Commander-in-Chief in arranging for the protection of his base at Cawnpore. He left behind at Cawnpore about 500 Europeans under the command of Major-General Charles A. Windham, C.B. Windham was directed by the Commander-in-Chief to place his troops within the entrenchment which, on the occupation of Cawnpore by Havelock in July, had been hastily constructed on the river, and to send into Oudh the detachments of European infantry which might arrive, and on no pretext to detain them.

Having by these instructions secured his base, Sir Colin Campbell started on the 9th, accompanied by his staff, to join Hope Grant's camp in the sandy plain 4 miles beyond Banní. He reached it that afternoon, had a cordial meeting with Hope Grant and his old friends of the Delhi force, and after a short conversation gave his orders for the following day.

In pursuance of these orders Colonel Adrian Hope was sent forward to the Alumbagh, the following day, in charge of a large convoy of provisions. The provisions were to be left there and the carts laden with sick and wounded to be sent back to Cawnpore. That same day a portion of the siege train, escorted by the Naval

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Brigade arrived in camp. Early in the morning of the 10th there suddenly presented himself to the astonished gaze of Sir Colin Campbell, a European gentleman disguised as a native, and who in that disguise, had managed to make his way through the beleaguering forces, carrying on his person important dispatches. His name was Kavanagh. To understand thoroughly the nature of the information he brought the reader is asked to remember the account given in the last chapter of this history of the arrival of the relieving force under Outram and Havelock.

On the night of the 25th September the advanced portion of Havelock's force had entered the Residency. They were followed next morning by all but the rear guard. It had already been discovered that the advent of Outram's force constituted not a relief but a reinforcement, that means of transport for the ladies and children, the sick, and the wounded were wanting, that an enormous addition had been made to the hospital list, and that even had transport been available the combined force was not strong enough to escort it to Cawnpore. But one course then remained open to Outram, and that was to hold the Residency, until he should be effectively relieved by Sir Colin Campbell.

Outram's first care was to provide accommodation for the largely increased force. With this view he at once caused the palaces extending along the line of the river the Táráwálá Koti, the Chuttur Munzil, and the Farhat Bukhsh to be occupied, the enemy's works and guns in the vicinity being at the same time destroyed. These posts were taken on the morning of the 26th September.

The six weeks which followed the arrival of Outram's force have not been inaptly described as a blockade. His arrival had terminated the siege. The danger of being overwhelmed by the masses of the enemy had in a great measure passed away. Before the arrival of the reinforcements there had generally been the excitement of defence; it had now become the more stirring excitement of attack.

On the 27th September, for instance, a party of the 1st Fusiliers and some men of the 32nd Regiment, under the command of Major Stephenson, made a sortie for the purpose of taking some guns in the enemy's Cawnpore battery. The British troops were met by a very heavy fire from the enemy, and although they succeeded in spiking three of the enemy's guns, they were unable to bring them back within the defences. On their return, they were exposed to so destructive a fire from the tops of houses and loopholes, that they found it most difficult to carry in their killed and wounded.

On the 29th September, three sorties were made simultaneously. One of these proceeded from the left square of the Brigade Mess, the second from the Sikh Square, the third from the Redan. The third party, composed of 200 men, with a reserve of 150 from

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the 32nd and 5th Fusiliers, drove the enemy from their guns, and advanced till they came to a lane commanded by an 18-pounder. In this advance they lost Capt. McCabe, of the 32nd, a most distinguished officer, who was then leading his fourth sortie. Major Simmons, of the 5th Fusiliers, was also killed, and it being ascertained that no further advance could be made without considerable loss, the party was recalled. The second party from the Sikh Square was composed of men from the 32nd, 78th, and 1st Madras Fusiliers, 200 in all, and supported by some men of the 13th Native Infantry, under Lieut. Aitken. They succeeded in demolishing several houses and batteries. The first party from the Brigade Mess, commanded by Capt. Shute, and composed of men from the 32nd, 64th, and 84th, succeeded in destroying a 24-pounder gun, and in spiking two mortars and four native guns of small calibre. Their loss was very severe. Again on the 2nd November Lieut. Hardinge led a party composed of the 32nd, 84th, and 1st Madras Fusiliers, and seven artillerymen, to destroy some guns on the Cawnpore Road. This was done effectively and almost without opposition. To write a detailed account of these operations would require a volume devoted wholly to the Siege of Lucknow. Constantly recurring are the names of Wilson, Aitken, Ouseley, Apthorpe, Forbes, Graham and Cubitt, of the infantry; McLeod Innes, Anderson, and Hutchinson, of the Engineers. Every native officer of the 13th Bengal Native Infantry was killed, wounded, or died during the siege. The subahdar of the regiment, Aman Singh, a gallant old Rájpút, received two wounds at Chinhut, but struggled back into the Residency with the beaten troops from that fatal field, and served throughout the siege, and for many years afterwards as a subahdar-major of the Regiment of Lucknow. All ranks of that gallant regiment the 13th as well as the 48th, and 71st Native Infantry received the Order of Merit.

On the 2nd October, Outram, finding that the garrison was greatly annoyed by a fire from a very strong battery, known as Phillip's Garden Battery, on the Cawnpore Road, ordered a party formed of detachments from several regiments under Colonel Napier to storm it. Napier conducted the attack with his usual combination of science and daring, and took the battery, with the loss of two men killed and eleven wounded. He captured three guns—two 9-pounders and a 6-pounder. There was nothing strange in this, but it was remarkable that he should have rescued a private soldier of the Madras Fusiliers, who had fallen down a well, and had remained there three days, undiscovered by the rebels who were occupying the place.

Outram had been much impressed with the advantages of adopting the direct Cawnpore Road as the mode of communication with the Alumbagh. To carry out this idea, he directed Major Haliburton,

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of the 78th Highlanders, to extend the position in that direction, working from house to house. This operation which was full of danger was begun on the 3rd. The next day Haliburton was mortally wounded. Stephenson, of the Madras Fusiliers, who succeeded him shared the same fate on the 5th. Still the work was persevered with. Several houses were pierced through and at last, on the 6th, a large mosque was reached. This place was in great strength of itself and was occupied in considerable force. The intermediate houses were blown up, and the 78th were located in the garden in which rested the battery captured on the 2nd. This became an important post, and not only protected a considerable portion of the old entrenchment, but connected it with the palaces which had been occupied previously.

The work of mining and countermining, so remarkable during the siege, was still further developed under the superintendence of Colonel Napier. Ably seconded by the Engineer officers, Crommelin, Anderson, McLeod Innes, Hutchinson, Russell, Limond, and by others, all the efforts of the enemy in this direction were frustrated. Some of the 32nd, trained during the siege, made themselves remarkable for their dexterity in mining. For general purposes a company of miners was formed of volunteers from the several corps, and placed under the orders of Capt. Crommelin. These "soon gave him the ascendancy over the enemy who were foiled at all points, with the loss of their galleries and mines, and the destruction of their miners in repeated instances." *

The effect on the enemy of the occupation as outposts of three strong positions commanding the road to the iron bridge, was remarkable. During the siege they had occupied positions within a few yards of our entrenchments. From these they were now driven back to a distance so great, that their musketry fire had no chance of doing mischief inside the old position. They accordingly, with considerable skill, altered their tactics. They withdrew their guns to a point whence the fire would clear the outer defences and fall within the entrenchment. The plan was ingenious, and was so far well worked that the point of fire was constantly shifted. It might have been very damaging but for one defect, viz. want of confidence in the success of the plan, which produced, therefore, want of continuity in the working of it and proved fatal.

* Sir James Outram's official report. "I am aware," he also said, "of no parallel to our series of mines in modern war. Twenty-one shafts, aggregating 200 ft. in depth, and 3,291 ft. of gallery have been executed. The enemy advanced 20 mines against the palaces and outposts; of these they exploded three which caused us loss of life, and two which did no injury; seven had been blown in, and out of seven others the enemy have been driven, and their galleries taken possession of by our miners."

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On the 9th October the garrison was cheered by the news that Delhi had fallen and was completely in our power, that the King was a prisoner, and that Greathed had set out to lead a brigade to Cawnpore. This news was confirmed the following day by the further intelligence of the victory gained by Greathed at Bulundshahr. From this date relief became a question of time, and if relief could arrive before the 20th November, Outram felt that all would be well. He believed from the information officially given him that even on the reduced scale of rations allowed, the supplies in the Residency would not feed the force longer than the 20th. But this was an entire misconception on the part of the supply department, for the supplies would have lasted for a far longer period.

It was mainly the belief that Outram's supplies were nearly exhausted that induced Sir Colin Campbell to march to Lucknow before disposing of Tantia Topee and the Gwalior troops. Still, though the greatest enemy was impatience, the efforts of the enemy outside the walls never slackened; nor were they wholly without effect. Many officers were killed or wounded between the 25th September and the 10th November, among the former being Lieut. Graydon, of the 44th Native Infantry, Capt. McCabe, of the 32nd, and Capt. Hughes, of the 57th Native Infantry, and among the latter, Browne, Edmonstone, Capt. Lowe, of the 32nd, and Assistant Surgeon Darby, of the same regiment. On the south side of the entrenchment the fire continued to be especially galling, several bullets entering the loopholes. Complete exposure on this side was certain death. On the 4th November, Dashwood of the Bengal Army, a very gallant officer, lost both his legs by a round shot, whilst sketching in the Residency compound. He had been warned by a first shot passing near him, but he would not stir.

On the 6th November, news reached the garrison that Hope Grant had encamped on the Lucknow side of the Banní Bridge, and that he was to wait there for Sir Colin Campbell, whose arrival at Cawnpore was also announced. Sir James Outram had previously forwarded to the Alumbagh a dispatch for Sir Colin, in which were contained plans of the city and its approaches, and his own ideas as to the best mode of effecting the junction of the relieved and the relieving forces. He had advised the Commander-in-Chief to make a détour from the Alumbagh to the right of the Dilkushá, and to advance thence by the Martinière and Sikandrabagh. By means of a preconcerted signal, he ascertained that his dispatch had safely reached the Alumbagh. The success of this mode of communication suggested the improvising of a semaphore telegraph, and the idea was no sooner conceived than it was carried out.

But though written descriptions might be useful to the Commander-in-Chief their value could in no respect equal that which might be conveyed by an intelligent member of the garrison, by one

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who had undergone the siege and withstood the blockade, and who could cast the light of personal experience on the insufficient description of a dispatch. But where was the man who would undertake to penetrate the serried lines of the enemy, knowing that death was synonymous with discovery? Disguise was necessary. To ask a man to dare this risk everyone felt was impossible. But it has often been found, amongst Englishmen, that the occasion produces the man. A clerk in one of the civil offices, by name Thomas Henry Kavanagh, caused General Outram to be informed, on the 9th November, that he was prepared to traverse in disguise the hostile lines, and to convey a letter to the Commander-in-Chief in his camp near Banní. Mr. Kavanagh's offer was the more heroic, as of all the garrison he was perhaps the most difficult man to disguise. Taller than the ordinary run of natives he was also very fair. But perfectly cognizant of these drawbacks, Mr. Kavanagh offered himself. General Outram loved a gallant deed; but brave as he was, and loving bravery in others, he yet shrank from exposing a man to the consequences of a deed such as that which Kavanagh proposed. He told him frankly the risks he ran, the almost certain fate that would befall him. But Kavanagh had made up his mind, dangers there were he knew, but having in view the all-importance of his mission he would brave them. Kavanagh chose the garb of a Badmársh, a native "swashbuckler," a soldier for plunder, of the sort which abounded in the ranks of the rebels. He wore a pair of tight silk trousers, fitting close to the skin, a tight-fitting muslin shirt, and over this a short yellow silk jacket. Round his waist he wound a white band, over his shoulders he threw a coloured chintz cloth, a cream-coloured turban being on his head, and he wore native slippers. His face and down to the shoulders, and his hands to the wrist, he stained with lamp-black dipped in oil, his hair being cut short. Thus disguised and wearing the shield and sword peculiar to the swashbuckler, Kavanagh at 9 o'clock on the evening of the 9th November, accompanied by a faithful native spy, by name Kananjí Lál, set out. His journey, though not without its alarms,* proved that Mr. Kavanagh had not counted vainly on his brave and resolute heart. He could not, indeed, reach the Alumbagh, but passing by it, he fell in on the morning of the 10th, with a party of Punjab Cavalry, by whom, after receiving their warm greetings and congratulations, he was escorted to Sir Colin Campbell.

The information thus received by that gallant commander supplied the one link which till then had been wanting to complete his mastery of the position. The following morning his engineer park arrived, and orders were issued for an advance the next day.

* Mr. Kavanagh wrote an account of this journey, *How I Won the Victoria Cross* (Ward & Lock). He died in St. Thomas's Hospital in 1883.

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The force under the command of Sir Colin Campbell consisted mainly of regiments which had already fought against the mutineers. They were the 8th, a wing of the 53rd, the 75th, and the 93rd Regiments of the Line, the 2nd and 4th Punjab Infantry (Sikhs), the 9th Lancers, Hodson's Horse, and other detachments; the Artillery consisted of 16 guns all tried at Delhi, a few Bengal sappers, and some Punjabi pioneers, and 250 men of the Naval Brigade, with eight heavy guns, and two rocket tubes mounted on light carts. The total number of fighting men, European and Native, was estimated at 3,400.

It was curious to mark the difference between the old Indian troops and the Highlanders in their reception of Sir Colin. Anxious and fixed was the gaze of the former as he rode down their ranks —men evidently trying to measure the leader who had been sent to them from so far. Enthusiastic beyond expression was his reception by the latter. It was seen at once that to him was accorded their entire confidence, that under him they would go anywhere and do anything. At sunrise on the following morning the troops advanced. The plan upon which Sir Colin Campbell had determined, and he was well instructed by Sir James Outram while possessing the advantage of the presence by his side of Mr. Kavanagh, was to move on the Alumbágh; to store within that enclosure all the tents, and, having drawn to himself the detachments still in rear, to make with a wide sweep a flank march to the right, on the Dilkoosha Park and the Martinière; starting afresh from these points, to force the canal close to its junction with the Gúmti; then covered by that river to advance, up its right bank on the Sikancharbágh. This point once secured, a portion of the force could make a dash southwards. The main body, meanwhile forcing the Shah Nujif, and the Moti Mahál, would open out the way for a junction with Outram. To support this operation, Outram would co-operate by a heavy fire on the intermediate positions held by the enemy from all the guns in the Residency; having forced them he would move out, with all his sick and wounded, women and children, and treasure, between the Gúmti and the Kaiserbágh, and effect a junction with the Commander-in-Chief. It was based upon the plan drawn up by Outram, and transmitted to Sir Colin by the hands of the gallant Kavanagh, on the 9th.

To carry out this plan, the little army set out at sunrise on the morning of the 12th November. It had marched barely 3 miles when the advance guard headed by a squadron of Hodson's Horse, commanded by Lieut. Gough, striking the road leading to Jalálábád came under the fire of some light guns, covered by a line of fieldworks. Capt. Bourchier at once brought up his field battery, and opened a fire which soon silenced the hostile guns. The rebels attempted to remove these guns, but Gough was amongst them like lightning,

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and drove them from the field with the loss of two of their pieces. No further opposition was offered to the progress of the force to the Alumbágh. The camp was pitched under cover of the Alumbágh. Here the force halted for the following day.

The 13th was devoted by Sir Colin Campbell to making arrangements for a decisive advance on the next day. He first despatched a small brigade under the command of Colonel the Hon. Adrian Hope,* of the 93rd Highlanders, an officer of great attainments and brilliant promise, to take possession of the fort of Jelálábád in the right rear of the position at Alumbágh. Hope found that the fort had been evacuated, and returned after rendering it useless by blowing in one of its faces.

Whilst one brigade was engaged in this operation, Sir Colin caused all the camp equipage not required for the hard work in prospect to be stacked within the enclosure. He directed, also, that whilst supplies for 14 days for himself and the troops in Lucknow should accompany him, every soldier should carry in his haversack provisions for three days' consumption. By successive reinforcements and the junction with the Alumbágh garrison, the force had now been augmented to about 5,000 men of all arms.

The Naval Brigade, commanded by Capt. William Peel, consisted of 250 men of the crew of the *Shannon*, seamen and marines, having with them eight heavy guns and howitzers, drawn by bullocks. The Cavalry Brigade commanded by Brigadier Little was composed of two squadrons of the 9th Lancers and one each of the 1st, 2nd, and 5th Punjab Cavalry, and of Hodson's Horse. There were also a company of Royal Engineers, a company of Madras Sappers, a few Bengal Sappers who had served at Delhi, and two companies of newly-raised Punjab Pioneers. The Infantry Brigades were the 3rd, the 4th, and the 5th, commanded by Brigadiers Greathed, Adrian Hope, and Russell respectively.

On the evening of the 13th Sir Colin rode out to reconnoitre, and the following morning at 9 o'clock he gave the order to march. The advance was made from the right, through the fields, crossing the several roads leading from the city at right angles. The turning movement was made at the point expected and the advance bringing forward their right shoulders moved directly on the wall of the Dilkusha Park. As the advance neared the enclosure a heavy matchlock fire was opened upon it from the left. Reinforcements were at once sent to the front, and the British guns opened upon the group whence this fire proceeded, and silenced it. The British skirmishers advancing drove back the rebels and the Dilkusha was thus carried almost without a blow.

The infantry composed of a battalion, made up of companies from

* This distinguished officer was killed at the attack on Fort Rohia in Oudh in April, 1858.

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the 5th Fusiliers, the 8th, 64th, and 78th Foot, commanded by Lieut.-Colonel Hamilton of the 78th, and supported by the guns dashed down the slope and carried the Martinière, the enemy not waiting to receive them, but retreating across the canal with all speed, pursued by our cavalry.

Both these important places having been carried the Commander-in-Chief brought up the 4th Brigade and arranged it in position in the gardens of the Martinière. He located there also a troop of horse artillery, and the 5th Brigade was posted on the left in front of the Martinière. These arrangements had not been made one moment too soon. They were hardly completed, when it became evident from the massing of troops on their centre, that the enemy were contemplating an aggressive movement. About 400 yards to the right of the wall of the Dilkusha Park as one faces the canal is the bridge connecting the Martinière plain with the Hazrat-gunj main street. It was on this bridge that the rebels, about 5 o'clock in the afternoon, came down in great numbers and with several guns.

Bourchier's Battery and Peel's 24-pounders occupied a position on some high ground on the left of the bridge, whence they were able to direct a concentric fire on the angle formed by the canal near the bridge, and where the enemy was massed in large numbers. Their fire speedily crushed the enemy out of this position. Then Adrian Hope, forming up his brigade, pushed across the bridge, drove back the enemy with heavy loss, and secured a lodgment on the other side. The attack of the rebels had failed.

That night the men slept with their arms by their side, ready for prompt action. The following day, the 15th, was spent in making preparations for the grand advance. Then Sir Colin made his final arrangements. The whole of his heavy baggage, his supplies for 14 days, he stored in the Dilkushá. Into the palace all the sick and wounded were conveyed. Defences were thrown up round that building, and a force was detailed to guard it.

Having made all the arrangements which skill and foresight could suggest, Sir Colin signalled to Sir James Outram by a code previously arranged, that he would advance on the morrow.

Early on the morning of the 16th the heavy guns were withdrawn from the advanced pickets on the canal, and the detachments of Adrian Hope's Brigade which had been sent to the front rejoined their regiments. The advance guard moved forward from the extreme right. Following the advance guard marched Adrian Hope's Brigade, then Russell's; then the Ammunition and Engineers' Park. Greathed's Brigade followed the remainder of the force as its rear guard. The advance guard, then marched along the bank of the Gúmti through the lane and enclosures without meeting an enemy.

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Suddenly for the first time the enemy took the alarm. First from men occupying huts and enclosures in advance of the building, then from the mass of men in the Sikandarbágh* itself, poured an overwhelming fire on the troops forming the advance. Their position was in a military point of view desperate, for they were exposing their flank to the enemy. For a distance of 120 yards to the walled enclosure of Sikandarbágh, they were broadside on to the enemy's fire. The situation was indeed critical. One company of the gallant 53rd in skirmishing order lined the enclosures bordering on the lane, but their numbers were few, and the fire of the enemy was concentrated; the cavalry were jammed together, unable to advance, and the high banks on either side seemed to offer an impassable barrier to artillery. But, up the steep bank the daring Blunt led his gallant troops, and "conquering the impossible," brought them, guns and all, into an open space between the Sikandarbágh and another large loopholed building, exposed to a terrific cross-fire as he advanced. Here unlimbering, he opened with his six guns on the Sikandarbágh. Never was anything done better. Travers followed with his heavy battery, and the sappers and miners having demolished a portion of the high bank, he too was able, by the aid of the infantry, to bring two of his 18-pounders into position and to open fire against the angle of the enclosure. In less than half an hour their fire made a breach in the wall which might be practicable for stormers.

Meanwhile the infantry of Adrian Hope's Brigade had been ordered to lie down, covered by a small bank and some trees. But the moment the breach was considered practicable the bugle sounded the signal for assault. It was made by the 93rd Highlanders and the 4th Punjab Rifles, supported by the 53rd and a battalion of detachments. The Highlanders, under Lieut.-Colonel Ewart, and the Sikhs, under Lieut. Paul, and a native officer of the Sikhs, Subadar Gokal Singh, dashed forward. All ran towards the hole—a small hole in a bricked-up doorway, about 3 ft. square, and about the same distance from the ground. A Sikh of the 4th Rifles reached it first, but he was shot dead as he jumped through. A similar fate befell a Highlander in his track. A young officer of the 93rd, Richard Cooper by name, outstripping the majority of his comrades was more fortunate. Flying, so to speak, through the hole he landed unscathed. Cooper was immediately followed by Colonel Ewart, of the 93rd, and Capt. Lumsden and three privates, then by eight or nine men, Sikhs and Highlanders. Another officer, Capt. Burroughs, of the 93rd, also penetrated within the enclosure but was almost immediately attacked and severely wounded. Lumsden was

* The Sikandarbágh, Anglice, "the garden of Alexander," was a high-walled enclosure, about 150 yards square, with towers at the angles.

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killed by a musket shot. Ewart, forcing his way into the courtyard, pushed forward with his following against the men at the other end of it. The few Highlanders and Sikhs then rushed at them and a desperate hand-to-hand encounter ensued. At the critical moment the bulk of the brigade, Highlanders, the Sikhs, and the 53rd, poured in to the rescue.

Impatient of the delay which would be caused by jumping singly through a narrow hole, the bulk of the storming party had turned to the left to force a way by the gate of the enclosure. This gate was locked and barred; and although the men used all their efforts, firing their pieces at the lock, some time elapsed before it gave way. But at last it yielded, and the 93rd and Sikhs dashed through it. Almost simultaneously the 53rd forced a barred window to the right of it and joined in the rush to the rescue of Ewart, of Cooper (still fighting in spite of his wound), and their comrades.

Through the gate and window, and through Cooper's hole which the sappers had succeeded in enlarging, the stormers poured as fast as they could make their way. As they entered the rebels fell back into the towers at the angle of the enclosure, and opened a heavy and continuous musketry fire on our men, occasionally diversifying this mode of fighting by descending to a hand-to-hand encounter. In one of these, Colonel Ewart succeeded in cutting down two native officers who guarded a colour, and in capturing the colour, which he presented with his own hand to Sir Colin Campbell. The fight for the possession of the enclosure was bloody and desperate the rebels fighting with all the energy of despair. Every room, every staircase, every corner of the towers was contested. Quarter was neither given nor asked for, and when at last the assailants were masters of the place more than 2,000 rebel corpses lay heaped around them.

About 300 yards along the road leading from Sikandarbágh to the Residency there was a small village with garden enclosures round it, while about 250 yards further on and 100 yards to the right of the road stood the Sháh Najif, a large mosque, situated in a garden enclosed by a high loopholed wall. This wall was nearly square and very strong. Between it and the Sikandarbágh amidst jungles and enclosure, to the right of the little plain, was a building on a high mound called the Kadam Rasúl.

The afternoon was now waning and Sir Colin Campbell deemed it essential to carry the Sháh Najif. The operation was dangerous and most difficult. On the right the Kadam Rasúl was assaulted and carried by a party of Sikhs. There was great confusion in the narrow lane leading up from the rear. The animals carrying the ordnance and engineer supplies unable to get out on either side got completely jammed, and the confusion near the Sikandarbágh had got to such a pitch that all passage had become impassable; and

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had it not been that a staff officer discovered a by-path leading into a broad road which abutted on the Sikandarbágh, neither men nor ammunition could have been brought up.

In front of the Sháh Najif the battle made no way, and the men were falling fast. It was now apparent that a crisis had been reached. Our heavy artillery could not subdue the fire of the Sháh Najif; we could not even hold permanently our present advanced position under it. But retreat to us there was none. What shot and shell could not do, the bayonets of the infantry must accomplish.

Collecting the 93rd about him, the Commander-in-Chief addressed a few words to them. He told them that the Sháh Najif *must be taken;* that the artillery could not bring its fire under, so they must win it with the bayonet. Giving them a few plain directions, he told them he would go on with them himself. The grey-haired veteran of many fights rode at the head of the troops. As they approached the nearest angle of the enclosure, the soldiers began to drop fast; but without a check they reached its foot. There, however, they were brought to a stand. The wall, perfectly entire was nearly 20 ft. high, and well loopholed; there was no breach, and no scaling ladders.

Unable to advance, unwilling to retire, they halted and commenced a musketry battle with the garrison. But all the advantage was with the latter, who shot with security behind loopholes, and the Highlanders went down fast before them. At this time nearly all the mounted officers were either wounded or dismounted. Two of Peel's guns were now brought up to within a few yards of the wall. Covered by the fusillade of the infantry, the sailors shot fast and strong; but though the masonry soon fell off in flakes, it came down so as to leave the mass behind perpendicular, and as inaccessible as ever.

Success now seemed impossible. The dead and wounded were ordered to be collected and carried to the rear. Some rocket frames were brought up, and threw in a volley of these fiery projectiles with such admirable precision, that just skimming over the top of the rampart they plunged hissing into the interior of the building, and searched it out with a destroying force. Under cover of this the guns were drawn off. The shades of evening were falling fast and the assault could not much longer be continued. Then, as a last resource, Adrian Hope, collecting some 50 men, stole silently and cautiously through the jungle and brushwood away to the right, to a portion of the wall on which he believed some injury to have been inflicted, having observed signs of this before the assault. Reaching it unperceived, a narrow fissure was found, and up this, a single man was with some difficulty pushed. He saw no one near the spot, and so helped up Hope, Ogilvy, Allgood, the Assistant Quartermaster-General, and some others. The numbers inside soon

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increased, and as they did so they advanced, gradually extending their front. A body of sappers, sent for in haste, arrived at the double, the opening was enlarged, the supports rushed in. Meanwhile Hope's small party, pushing on, to their great astonishment found themselves unopposed. Gaining the gate they threw it open for their comrades. Panic-stricken, apparently, by the destruction caused by the rockets and the sudden appearance of some of the assailants within the walls, they fled from the place, and gave up the struggle just when victory was secure. Never had there been a harder-fought day,* but never was a result gained more satisfactorily. A lodgment had been made for the night and the order was then given to bivouac. The main body of the 93rd garrisoned the Shah Najif; another portion of that regiment occupied the barracks. The troops not occupying these two posts lined the roads and maintained the communications. The field hospital for the wounded was established in some huts opposite the Sikandarbágh which might be regarded as the central point of the position taken up for the night. The men lay down in line with their arms by their sides.

During the hours employed by the troops under Sir Colin Campbell in attacking the Shah Najif, the Residency garrison under Sir James Outram were using all their efforts to effect a diversion. They captured some of the positions to the east of the Residency, and from these maintained a continuous fire of guns and mortars on the rebels.

The British and Sikh troops, lying in unbroken order with their arms by their sides, were awakened early in the morning of the 17th, not by their own bugles, but by the bells of the city and the beating of the enemy's drums. The British soldiers sprang up with alacrity, each man in his place, ready for action. But the enemy did not come on. Sir Colin Campbell was, therefore, able to carry out his own plan and to choose his own time. His plan was first to carry the Mess House, a large masonry building defended by a ditch 12 ft. broad, surmounted by a loopholed wall behind, about midway between the Sháh Najif and the Kaiserbágh. Much would still remain to be accomplished. The strong positions of the Kaiserbágh, and of the Begum's palace covering the vast city behind them would still remain in the occupation of some 30,000 unsubdued foes, and it was in the face of these that Sir Colin would have to withdraw the women and children, the sick and the wounded. Sir Colin commenced his operations with great caution. First, he deemed it advisable to secure his left flank. To prevent the enemy from acting on our left rear he

* "It was an action almost unexampled in war."—Sir Colin Campbell's Dispatch, 18th November, 1857.

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detached the 5th Brigade under Brigadier Russell to carry the house called Banks's house and four bungalows close to the barracks, to convert them into military posts. Possessing now the barracks and the Dilkushá the occupation of Banks's house and the bungalows would sever the communication between the Kaiserbágh and the Dilkushá and would cover the left rear of the attacking force.

Having thus made arrangements to secure his communications Sir Colin directed William Peel to open fire with his heavy guns on the Mess House. The fire continued from early morning till 3 o'clock in the afternoon. At that hour the musketry fire of the enemy having been almost completely silenced, it appeared to Sir Colin that the Mess House might be stormed without much risk. It was a building of considerable size, and surrounded by a loop-holed mud wall, covering a ditch about 12 ft. broad, scarped with masonry. The ditch was traversed by drawbridges, but whether these were down or up was unknown to the storming party.

Never was a daring feat of arms better performed. Leading his men at the double across the intervening space, exposed to a hot fire from the neighbouring buildings, Hopkins, of the 53rd, reached the mud wall, dashed over it, crossed the drawbridge, fortunately left down, and entered the Mess House. He had but just gained the place when Roberts (afterwards Field Marshal Earl Roberts and Commander-in-Chief in India) galloped up, handed him a Union Jack, and requested him to hoist it on one of the turrets. Followed by one of his men, Hopkins climbed upon the roof, and giving three cheers, planted the flag on the summit. The flag had not been up ten minutes before a round shot cut the staff and sent it down into the garden. Again did Hopkins plant it, and again it was knocked down. He asked to hoist it again, but just at the moment, an order arrived from the Commander-in-Chief forbidding the further display of it. Simultaneously Wolseley, moving on a different point, had attacked the houses to the right of the Mess House, whilst Irby with a company of the supports, attempted to clear those on the left. Both attacks were successful, and the rebels being driven out fled in panic to the Motí Mahal.

The victorious stormers followed the flying enemy. Wolseley hurried on to the wall of the Motí Mahal, but the opposition was great, and the wall was solid, and the gateway had been blocked up, he had therefore to send back for the sappers. These promptly came up and succeeded in making narrow openings in the wall. Through these Wolseley and his men eagerly rushed, and attacked the network of buildings within. The resistance they encountered was, however stout and desperate, every room being contested. At length, however, he expelled the enemy, and the Motí Mahal, the last building held by the rebels on the line communicating with Outram and Havelock, came completely into British possession.

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An open space, nearly half a mile in width, still intervened between the assailants and the advanced positions of Outram and Havelock. This space was exposed to heavy musketry fire from the Kaiserbágh and could not be crossed without imminent risk. But the risk did not prevent the two gallant generals and their staff from crossing the space to meet the Commander-in-Chief.

They started, eight officers and one civilian. They were Outram, Havelock, Napier (afterwards Lord Napier of Magdala), Vincent Eyre, Dodgson, the Deputy Adjutant-General, young Havelock, the aide-de-camp, Sitwell, Russell of the Engineers, and the gallant Kavanagh. They had not gone many paces before they were seen by the enemy, and the musketry fire from the Kaiserbágh redoubled. Napier, young Havelock, Sitwell and Russell were struck down. Outram, Havelock, Eyre, Dodgson and Kavanagh alone reached the Motí Mahal uninjured; then to borrow from the appropriate language of Sir Colin Campbell, "the relief of the garrison had been accomplished." But a most difficult and dangerous task still remained. The garrison, with women and children, sick and wounded, guns and stores had to be withdrawn; and to effect this in the face of the vast force of the enemy was no easy task.

One narrow lane alone led to the rear, and through it the whole force had to be filed. To protect the march of the convoy, the whole of the immense line, extending from the ruined walls of the Residency to the wooded park of the Dilkushá required to be held, and this gave a most hazardous extension to our forces—far too weak for the maintenance of so extended a position. To keep any considerable reserve in hand was impossible. The enemy still occupied the Kaiserbágh in great force. From the Kaiserbágh they threatened the flank and the left rear of the British Army. Sir Colin's first object was then to silence the fire from the Kaiserbágh. He directed the colonels of the 93rd, the 82nd and the 23rd commanding the posts covering the left rear, simply to maintain their positions, whilst he would himself personally superintend the delicate operations of the withdrawal, by the road already traversed, of the sick and the wounded, the women and the children. The order was simple, and was carried out to the letter.

On the morning of the 20th, as a preliminary measure, William Peel opened on the Kaiserbágh a tremendous fire from his heavy guns. This fire continued during that day, the day following, and the 22nd, increasing every hour in intensity. It gradually assumed the character of a bombardment. The enemy suffered enormous losses, and on the evening of the 22nd three breaches in the walls of the Kaiserbágh invited assault. Such however was not the intention of Sir Colin; the bombardment had, in fact, been used to cover the withdrawal of the women and children, sick and wounded. Long before it concluded, these had reached

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the Dilkushá in safety. The three breaches effected on the evening of the 22nd were used to carry out the retreat of the glorious garrison of Lucknow. Whilst the rebels passed that night in devising measures to meet the assault which they expected on the morrow, the garrison which had so long kept them at bay, the veterans of Inglis's force, the victors in many fights of Havelock's and Outram's, began to retire at midnight. The guns which they could not carry away they rendered useless. Then behind the screen of Campbell's outposts, Inglis's and Havelock's toilworn bands withdrew. Then these began to retire also; the pickets fell back through the supports, the supports glided away between the intervals of the reserve, the reserve when all had passed silently defiled into the lane, thick darkness shrouded the movement from the gaze of the enemy, and hours after the position had been quitted, they were firing into the abandoned posts.

Hope's Brigade, which had so nobly headed the advance had also covered the retreat. Before daylight on the 23rd the last straggler had quitted the camp at Dilkushá. The reunited force remained at the Dilkushá during that day and the ensuing night. But there was no rest for officer or private. The detachment parties who had come up with the relieving force had to be distributed to their different regiments; carriages had to be allotted; arrangements for the convoy of the women and children under responsible officers had to be made. On this day a reorganization of the whole force was made to remain in operation as far as the Alumbágh.

Havelock died on the 24th. On the morning of the 26th his remains were consigned to a humble grave in the Alumbágh. His gallant son, the leaders who had been associated with him, Campbell, Grant, Outram, Inglis, Napier, and others and a crowd of officers, followed him to his last resting place. He had fought a good fight; he had died, as he had lived, in the performance of duty. The life of Havelock had been a life devoted to his profession. Gifted with military abilities of a very high order, and conscious that he possessed these abilities, he had borne without repining the disadvantages of slow promotion. But every trial of Fortune had found Havelock, cheerful, resolute, and devoted. To the smallest office he gave his best abilities, and had striven also to prepare himself for the eventualities which were to follow. He had lived long enough to hear that his Queen and his countrymen had appreciated his noble qualities, that his name had become a household word among the homes and the hearths of England.

Sir Colin decided on the 26th that Sir James Outram should remain at Alumbágh with a force of about 4,000 men of all arms, 25 guns and howitzers and 10 mortars. Outram would thus occupy a position threatening Lucknow, and would retain it till

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the Commander-in-Chief having placed his convoy in safety, and disposed of the Gwalior mutineers, should return to act offensively against the city of Lucknow.

The chapter which will follow with an account of the final Capture of Lucknow will comprise references to the very distinguished services of several officers of the Royal and Indian Engineers both at the Relief and Capture of the City, among whom should be noted the names of Field Marshal Lord Napier of Magdala, General Sir Lothian Nicholson, General Sir Henry Harness, General Sir Wilbraham Lennox, General Sir Frederick Maunsell, General Sir Richard Harrison, Major-General Greathed, Colonels A. Lang, E. Malcolm, J. G. Forbes and others.

(*To be continued*).

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MEMOIR.

COLONEL A. J. HEPPER, D.S.O., R.E.

ON the 23rd April there passed away, almost unnoticed in the turmoil of our present life and death struggle, one of our old officers who has done his share in maintaining the reputation of the Corps and passing on the ripe fruit of his knowledge to rising generations of His Majesty's Service.

Albert James Hepper was born at Gibraltar on October 24th, 1839, the third of a family of 11 children. His father and grandfather had been settled on the Rock from the end of the 18th century and were established as regular residents. Such instruction as the Colony could afford in the groundwork of knowledge was sufficient to enable Hepper to pass the Matriculation Examination of London University after a year's tuition at Queen's College, Birmingham. He entered King's College, London, on 1st October, 1857, passing the following July for the Royal Military Academy which had recently been opened to candidates admitted by competitive examination.

Second in his batch he was gazetted Lieutenant, R.E., on 31d January, 1860. After the customary courses at Chatham he joined at Pembroke and was employed on fortifications and barrack works at Milford Haven, Tenby, and other places within the district till 1865 when he proceeded on foreign service to the Cape of Good Hope with the 23rd Company, under command of Capt. R. G. Thorold; Lieut. Arthur Hill being the other subaltern. Landing at East London the company marched 40 miles to King William's Town, which was reached after an arduous march over very bad roads on 8th September.

The headquarters of the C.R.E. were at Graham's Town and the company was broken up into detachments to maintain the numerous outposts held by the British garrison. Natal formed a part of the C.R.E.'s command and it fell to Hepper's lot to replace Capt. G. H. Gordon as C.R.E., Natal, from December, 1865, to February, 1867. This was a responsible position for a subaltern to fill and as there was no telegraph, and a mail only once a month, the C.R.E., Natal, of those days enjoyed a degree of independence which formed an excellent introduction to a career in which initiative and resource have to be combined with readiness to assume responsibility.

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Here he met many interesting people more or less well known in South African history and had the friendship of the Colenso family at the time when the famous controversy was at its height. He describes Adam Kock, the conqueror of Griqualand East, as a wizened little Hottentot dressed in secondhand clothes; his staff gorgeous in the discarded uniforms of the Cape Mounted Rifles. Pretorius, President of the Transvaal Republic, came to visit the Governor of Natal about this time. He is described as unostentatious, he and his escort having the appearance of farmers.

A further tour of service in King William's Town was broken by a visit to Cape Town where Lieut. Hepper was married on 19th September, 1867, to Miss Sophie Lees, second daughter of Richard Lees, of Greenhills, Oaken, near Wolverhampton, to whom he had been engaged before leaving England.

In October, 1869, Hepper returned to England, where he resumed duty at Aldershot, performing the duties of Divisional Officer, and being in charge of improvements to the Water Supply at Broadmoor Criminal Lunatic Asylum under the Home Office. He was appointed Adjutant to the C.R.E., Colonel Laffan, on 5th January, 1871, and was promoted Captain on 21st September, 1872, when he was transferred to the Gosport Sub-District of Portsmouth Defences. Service for the next few years included Aldershot, Chatham, Fort George, Edinburgh, where he was employed in completing the Brigade Depôt Barracks at Greenlaw, now known as Glencorse, the show barracks in Scotland.

About this time one of Mr. Cardwell's army reforms was the conversion of the Monmouth and Anglesey Militia Regiments into Engineers, and Capt. Hepper became the first R.E. Adjutant of the latter regiment on 1st April, 1877, a post he did not relinquish till 15th July, 1882. He received a letter from the D.A.G., R.E., expressing the satisfaction of H.R.H. the F.M. C.-in-C. at the good service he had rendered as Adjutant of the regiment.

His next service was at Dover, he being now Major having been promoted on 1st July, 1881. While there he received his first orders for active service in the Soudan, being appointed C.R.E., Wady Halfa, on 21st March, 1885.

Khartum had fallen and with it the heroic Gordon, and the intention was for the troops to advance after the summer heat had passed and march on Khartum. As everybody knows this intention was abandoned, but meanwhile Hepper's orders were to provide huts for the troops at Akasheh, Wady Halfa, Korosko and Assouan by June. It was not easy to provide the huts in the time available, there being no materials up the Nile except palm trees and millet straw. Bricks were made with Nile mud and baked in the sun. Contracts were made with native "sheikhs" for quantities of palm trees and straw. Every sapper and infantryman

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who could lay bricks was employed. Work could only be done in the cool of the morning and a couple of hours before sunset, yet all the troops were hutted by June. On 21st April the advance to Khartum was abandoned and the troops subsequently recalled.

Meanwhile the Soudan Railway was being pushed on southwards and was utilized for bringing back the troops on their way to Lower Egypt and other destinations. It was finally pushed on to Akasheh, towards the end of July, and a frontier post garrisoned by the Cameron Highlanders was erected by Capt. Blackburn, R.E., under Hepper's directions, at Kosheh, some 20 miles south of Akasheh.

On the withdrawal of the Nile Expeditionary Force, the British troops remaining in Upper Egypt were called the Nile Frontier Force and General, afterwards Lord, Grenfell assumed command on 9th July, 1885, Hepper being appointed C.R.E., Frontier Field Force, from that date. He accompanied the General on a tour of inspection to the south and to meet the rear guard of the Expeditionary Force, under command of General Brackenbury, afterwards Sir Henry Brackenbury, at Abri. On the way back the General and Staff rode to railhead to return to Halfa by train, but Hepper obtained permission to do the journey by boat as he was anxious to experience the sensation of going down some 90 miles of cataracts and rapids. This was now possible as the Nile was rising, and he arrived safely at Sarras in a "whaler" manned by eight Egyptian soldiers and steered by a Nile "*Reis*" in about 12 hours. The writer met Major Hepper on his arrival at Wady Halfa and gathered that the experience had been a thrilling one. A boat that followed next day met with disaster and five of its inmates were drowned.

The summer in the Soudan was not a pleasant time; it was very hot. Supplies were defective and luxuries non-existent; small blame then to those who succumbed to the enervating climate and Hepper was one of these, and had to go into hospital at Assouan, the Army Headquarters. "Fortunately," he says in his memoir, "the Arabs came down the river and attacked our advanced post at Kosheh." The General and Staff therefore left Assouan and arriving at Wady Halfa found the railway had been cut and the post at Ambigole Wells surrounded, and Kosheh beleaguered.

Lieut.-General Sir Fred. Stephenson, Commanding Troops in Egypt, brought down his Staff and reinforcements from Cairo and on 30th December defeated the Dervishes at Ginniss with great slaughter. Hepper was present with the 2nd Brigade throughout the action and subsequent clearing out of scattered parties of the enemy.

After another visit to Abri the Headquarter Staff Frontier Field

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Force came back to Halfa and there concerted measures for holding that place, as the frontier post, by Egyptian soldiers, all white troops to be withdrawn to Assouan and Cairo. So the forts and barracks at Kosheh and Akasheh were demolished and all useful material brought back for use by the C.R.E. in the Halfa Defences and 100 miles of railway were abandoned. The task of fortifying the new Wady Halfa Frontier naturally fell to Hepper and was most skilfully executed. The frontier was rendered practically impregnable against any Dervish attack.

Then followed a spell at Cairo and again at Assouan where General de Montmorency, afterwards Lord Frankfort de Montmorency, was commanding.

In November, 1886, the Dervishes came down again within 15 miles of Wady Halfa, and an expedition went out to look for them but no serious fighting ensued. So Hepper's active service concluded on 15th March, 1887, when he was transferred to Cairo for ordinary R.E. duties till relieved in 1888. Meanwhile he had been promoted to Lieut.-Colonel on 1st October, 1887.

Then followed a quiet time as C.R.E., Guernsey, and on 2nd July, 1890, by appointment as Asst.-Commandant, S.M.E., a post requiring many varied qualifications, involving as it did all the management of the *personnel* of the R.E. Depôt and Service Companies, control of Messes and other purely regimental as distinguished from educational duties. These were in the good old days of close-order drill and formal manœuvre. There were three battalions of R.E. and two Field Companies to be manœuvred in brigade on the Great Lines and the A.C. S.M.E. was the Brigadier. Colonel Hepper by position and rank and on account of previous experience was always selected to command a side, or to be Chief of Staff to a commander, and proved himself almost invariably to be on the winning side. It was the fortune of the writer to be his staff officer in many such sham fights in the course of which he was able to assimilate many sound ideas as to the rapid appreciation of a tactical situation from his chief.

The inevitable half-pay on completion of five years' service as Lieut.-Colonel ensued; this luckily proved to be short as appointment to the Ordnance Committee followed on 20th December, 1892, carrying with it the rank of substantive Colonel. Attending a levée held by H.R.H. the Commander-in-Chief at the Horse Guards, Hepper naively remarks that when he thanked H.R.H. for his appointment, the latter looked much relieved as most of those attending his levées were there to ask for something. The appointment lasted till 28th October, 1896, when the military career of the subject of this Memoir was concluded by a grand blow-up at Milford Haven where he was employed by the Ordnance Board on experiments with the pneumatic gun.

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Then followed a post as Engineering Inspector under the Local Government Board till March, 1906, when at the age of 67½ Colonel Hepper retired after having served the State for 48 years. His services were recognized by the Companionship of the Distinguished Service Order, Egyptian Medal, the Order of the Medjidieh and the Khedive's Bronze Star.

On 17th December, 1907, he had to bear the grief of the loss of his wife who died as she had lived, full of faith and concerned only for the welfare and happiness of those she left behind.

There is little more to say. The outbreak of the War found Colonel Hepper aged and perhaps a little infirm in his walk but full of mental vigour; taking an active interest in the progress of our arms and ready to help if need be. It fell to the lot of the youngest of his sons to be the first victim. While engaged in tending the wounded at the Battle of Mons he got left behind and is now a prisoner in Germany. The eldest who retired from the Corps in the rank of Major is actively employed as manager of the great Indian Peninsula Railway, and three others are actively engaged in His Majesty's Army.

The end came suddenly on the 23rd April last. He had been seized by a stroke the night previous and passed quietly away with just sufficient consciousness to recognize the only son available off duty, and his younger daughter who had watched over him with loving care ever since the lamented death of her mother had thrown the responsibility for the household on her hands.

He was laid to rest by the side of his devoted wife at Kensal Green on Monday, 26th April, 1915, followed to his grave by a few relatives and friends. His obsequies were like his life simple and unostentatious.

J.A.F.

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NOTICE OF MAGAZINE.

REVUE MILITAIRE SUISSE.

60th Year. Nos. 4, 5 and 6 (April, May and June, 1915), with Supplement.

No. 4.—April, 1915.

THE TECHNICS OF EXPLOSIVES.

The subject is treated under five heads. The first of these heads deals briefly with the history of explosives: it is explained that explosive mixtures when first discovered were used for incendiary purposes only, a common method of so employing them consisted in fastening the explosive to some missile which was then projected by catapults against the object attacked. A legend attributed the discovery of gunpowder to Schwartz, a Benedictine monk, in 1334 A.D.; this legend is, however, discredited, for gunpowder, it is said, was used for incendiary purposes in connection with the defence of Constantinople in 660 A.D. For a period of nearly 500 years gunpowder was the explosive most generally in use, as a propellant in firearms, as well as a destructive agent in mines. The discovery of guncotton was made in 1845: Noble, whilst carrying out experiments in 1863, first obtained nitroglycerine and later rendered it stable by an admixture of silicious earths, thus giving dynamite to the world. Chemists continued their researches on explosives and discovered compounds more powerful even than those last mentioned. Dewar invented cordite and Turpin mélinite (in 1887).

Under the second head certain general features relating to the subject are discussed and the conditions required to effect an explosion are briefly touched upon. Explosives are, it is pointed out, classified in two main groups, namely those termed "*chassants*," being those used as propellants and those termed "*détonants*" or "*brisants*," being those used to obtain disruptive effects. It will be recognized that these two groups are those which, in this country, are, in popular language, referred to as "low" and "high" explosives. The amount of heat and energy developed on the spontaneous decomposition of explosive substances is next touched upon, a table being furnished of the calories and the energy, per kilogramme of substance, obtained in the cases of some of the better-known explosives. This part of the subject concludes with a brief reference to the rate of propagation of the explosion, both in the case of the "low" as well as that of the "high" explosives.

Under the third head useful information is supplied in relation to the composition and manufacture of some of the more important explosives, *i.e.*, acetylene, nitroglycerine, guncotton, trinitrotoluene, lyddite, fulminate of mercury, black gunpowder, powdered chlorate of potassium, dynamite, and smokeless powder.

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Under the fourth head the question is taken up of the utilization of explosives in connection with rifle cartridges, common and shrapnel shell, torpedoes and submarine mines, bombs and hand-grenades, land mines and petards.

Under the fifth head is discussed the future of explosives. The question is there examined as to whether anything can be done to improve the efficiency factor of explosives in such a manner as to be capable of leading the way to the discovery of some extraordinary explosive capable of modifying the conditions of warfare. This examination leads to the conclusion that it would be extremely difficult to produce an explosive more powerful than those already known and in use to-day. As a matter of practical politics, there is little difference between the power of various explosives, so far as their disruptive effects are concerned; an armoured vessel will meet the same fate when successfully torpedoed, whether the charge used be mélinite or guncotton, dynamite or trinitrotoluene.

So far as the use of explosives as propellants is concerned, the deterioration of the inner tubes of guns fixes a limit; the explosives now in use are already responsible for a rapid corrosion of the inner tubes and the introduction of more powerful propellants, generating still higher temperatures than those now met with, is out of the question.

It is pointed out that the consumption of explosives, in the present war, is prodigious, but it is held to be nonsense to suggest that the blockade of Germany by the Navies of the Entente Powers is going to result in any serious diminution in the supply of explosives available for the use of the German Army. It is admitted that the cutting off of the supplies of Chili saltpetre has, during the past few months, caused a shortage of nitric acid in Germany, but it is held that Germany can manufacture this commodity quite as readily as Norway and Switzerland; she has not only her own works, but at the present time she absolutely controls the Vilvorde factory in Belgium, which for some years past has been producing nitric acid by the Ostwald process. Similarly, although it may no longer be possible to import cotton, very large quantities of this substance can be obtained from discarded clothing of all kinds. Further, there can be no shortage of alcohol and ether, nor of toluene, benzine, picric acid, etc., which can be readily distilled from coal tar, a commodity which Germany possesses in abundance.

THE MANNER IN WHICH THE "PERPETUAL NEUTRALITY" POSSESSED BY CERTAIN COUNTRIES HAS BEEN VIOLATED.

Fragmentary notes have, at various times, appeared in the *Revue* on the subject of neutral states and the violation of their neutrality; these notes have been collected together and rearranged for publication under the title given above. The article discusses the strategic effort made by Germany last year *viâ* Belgium and the Grand Duchy of Luxemburg. It is stated that the subject cannot be examined in all its bearing in the absence of documentary evidence; this evidence is not available at present; nevertheless, it is held, there cannot be any doubt whatsoever, that the violation by Germany of the territory of the neutral states, Belgium and the Grand Duchy of Luxemburg, has been a very serious

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political mistake and, more than that, a moral delinquency of still greater gravity.

It is suggested that the stigma cast by the whole world on the attack on the rights of a neutral nation by one of the belligerents and this belligerent's disregard for its own plighted word disclose war in a new character. The opinion is expressed that, from the foregoing points of view, in spite of all the sadness for which it is responsible, the War of 1914 will mark a step in advance on the road of civilization if, as there is every reason to hope, victory crowns the efforts of the armies of the Entente Powers.

The circumstances under which each of the neutral Powers of Europe, existing prior to the present war, acquired their international status is briefly traced, and attention is drawn to the fact that there are three shades in the character of the neutrality referred to as "perpetual"; this is shown in the following brief summary:—

Swiss Confederation.—The Republic voluntarily and deliberately assumed the status of a neutral state in 1648 (since recognized by the Treaty of Vienna, November, 1815) and maintains an armed force, as much in order to enforce respect for its neutrality as to provide for the eventuality which may impose a duty on the Republic, in its own interests, to change its policy in relation to its conduct in regard to international affairs under circumstances quite independent of the motives which originally prompted the adoption of the attitude of "perpetual neutrality." The Confederation, in fact, possesses all the attributes of a sovereign international state.

Belgium.—The kingdom is a neutralized, in contradistinction to a neutral state, and maintains an armed force exclusively for the purpose of warding off an attack on its neutral territories.

Luxemburg.—The Grand Duchy is a neutralized state and does not maintain an armed force, unless that of microscopic dimensions maintained for state ceremonial purposes may be called one. The Powers, which imposed "perpetual neutrality," having undertaken the obligation of protecting the Grand Duchy against aggression, the maintenance, on the latter's part, of a military force became, of necessity, a work of supererogation.

In view of the foregoing explanation it will be recognized why it is that, in considering the question of the violation of the territories of one or other of the three Powers mentioned above, it should be held that the violation of the neutrality of the Grand Duchy is, of the three possible cases of violation, the gravest and least justifiable.

The earliest example, since the Revolution, of the violation of the territories of a perpetually neutral state is that of which the Swiss Confederation was a victim in 1813; but in that case the Treaty which now regulates the present Helvetic neutrality did not then exist, although the principle involved had been admitted for more than a century.

The violation of the neutrality of Switzerland referred to occurred in the following circumstances:—After the defeat of the French Armies at Leipzig in 1813, Napoleon hastened back to France, in order to organize new armies, hotly pursued by the armies of the Allies (Russia, Austria, Wurtemberg and Bavaria). In December of the year in question, the forces of the Allies were partly echeloned along the Rhine, north of

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Basle, and partly held in reserve on the northern shores of Lake Constance. The problem which was exercising the minds of the Allied commanders was that connected with the invasion of enemy territory. Czar Alexander desired to respect the Helvetic neutrality, not so Austria. The latter power exerted diplomatic pressure on the Federal Government with the object of obtaining a voluntary renunciation of neutrality, at the same time, in order to be prepared for the contingency of the Federal Government not yielding in the matter, Schwartzenberg, the Austrian general, made preparations to force an entry into Swiss territory by a *ruse de guerre* (details are given in the article). Switzerland was deceived in regard to the Austrian intentions; the ruse succeeded and the neutrality of the Confederation was violated on the 13th December, 1813, Austrian forces occupied Berne and Soleure and crossed the Rhine on the 21st December; almost simultaneously, the Russians took possession of Basle. On this occasion, the Swiss Army was in no position to offer a resistance to the aggressors and its commander signed the terms of a capitulation on the 20th December, 1813.

Naturally, Germany had no more respect for the agreement, which she entered into with the Grand Duchy in November, 1902, containing the express provision whereby she undertook never to use the Luxemburg railway system for military purposes, than she had for the provisions of the Treaty of 1867, whereby she accepted the obligation to protect the neutral status of the Grand Duchy. On the 2nd August last, German soldiers were simply put on board armoured trains which, without any declaration of war, steamed into the capital of the Grand Duchy, which was occupied on the pretext that this step was rendered necessary for the protection of the Grand Ducal railways against enemy attacks.

Turning to Belgium, it is asserted that the developments which have taken place since 1870 right down to 1914, the changes of the concentration zones of the German armies, the railway construction undertaken during recent years, all betray the German design deliberately to invade Belgium. Everything appears to have been studied in minute detail; success in carrying out the operations depended entirely in a torrent-like descent on to Belgian soil. It can well be supposed that German "Realpolitik" left nothing undone to secure that all the trump cards should be in Germany's hands, so that the successful accomplishment of her purpose should eventually cover the iniquity of the means employed; Germany did not renounce the aid of that which has always been her principal forte, her genius for organization.

Germany has no capacity for improvisation; she relies on studied preparation. Her people are essentially analysts; that which others have invented, the Germans understand admirably how to perfect and turn to their country's advantage. So far as the preparations for this war are concerned, an example is to be seen in the uses they have made of aviation, a French invention adapted for war by German ingenuity. In other matters, too, it is hardly possible that the Great General Staff at Berlin can have neglected, in the 20th century, the admonitions of the great captains of past ages.—(*To be continued*).

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NOTES AND NEWS.

Switzerland.—The question of Swiss neutrality is further discussed. Reference is made to an incident chronicled in the April issue of the *Bibliothèque Universelle.* It would appear therefrom that Prof. Reiss (of Switzerland) who has been investigating matters in Servia had arranged to give an account of his work at the Sorbonne and was expecting a telegram, in which the date of the meeting was to be fixed. Owing to the non-arrival of the telegram enquiries were made and it then transpired that the communication desired had been addressed to the Professor, but it had been held back in the censor's office at Berne. The incident is unfavourably commented upon.

It is pointed out that a German Swiss has been allowed to address a meeting in Vienna, and a demand is made that similar treatment be meted out to the French Swiss. The correspondent urges that it is necessary, at the present juncture, that an opinion on current events should exist in Switzerland, but it must be Swiss opinion, and this can only be formed by permitting free discussion, provided that this discussion is carried on with sincerity and loyalty, and within the limits imposed by international courtesy. It is further held that an incident, such as the suppression of the Reiss telegram, denotes that a conception of neutrality exists which confounds the attitude of the individual, more exactly the citizen, with the responsibilities of the State. Citizens are properly held in check in that they are rigidly forbidden openly to attack the attitude deliberately adopted by the State, lest this should entangle the policy of the latter. Reasons are set out why Switzerland should continue to maintain its attitude of strict neutrality.

A brief reference is made to the suggestion made by certain deputies that the supreme decision on the proposed war tax should be withdrawn from the vote of the people. It is held that a grave error would be committed if this were done. The correspondent expresses the opinion: "We know that our good fortune exceeds our merits: if this is likely to cause us some expense, we will readily foot the bill."

This number of the *Revue* concludes with a bibliography relating to works of military interest.

No. 5.—*May,* 1915.

THE MANNER IN WHICH THE "PERPETUAL NEUTRALITY" POSSESSED BY CERTAIN COUNTRIES HAS BEEN VIOLATED.

The article commenced in the April number on the above subject is concluded in this number. It is suggested that the violation of the neutrality of Belgium, in 1914, should be compared with the violation of that of the Swiss Confederation, in 1813; considered side by side, these two historical examples become more suggestive. So far as the violation of the neutrality of Belgium is concerned attention is directed to the information contained in Emile Waxweiler's work, *La Belgique Neutre et Loyale;* an extract is published in which the statement occurs: "It is no secret that in the reign of Leopold II. the relations of the Belgian Court with the German Court were not particularly cordial. The Colonial policy of the old Belgian King and other diverse circumstances

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had been viewed with little favour by official circles in Berlin. Things changed from the commencement of the new reign" (*i.e.* in 1909). In the extract in question references are also made to the marriage of King Albert to the Duchess Elisabeth of Bavaria and the intimate relations established thereby between the Court of Brussels and that of Berlin. In June, 1910, the Belgian Sovereign and his Consort visited Berlin, and in the October of the same year, the Kaiser and Kaiserin proceeded to Brussels on a return visit and were received by the citizens in the Belgian capital with great cordiality. At a dinner given in his honour at the Royal Palace, the Kaiser, in responding to the toast proposed by King Albert, referred to his gratitude for the splendour of the reception accorded him by the Sovereign and the people of Belgium and stated that in it he recognized the pledge of the steadfast union, binding not only the Royal Houses of the two countries but also the people of Germany with those of Belgium. The German Emperor concluded his speech by expressing a vow to draw closer still the relations, full of confidence and of good-neighbourly intentions, already existing between the two peoples.

At that time the German relations with France appeared outwardly to be all that could be desired, so much so that in Belgian political circles many there were who had become confident that Belgium need never fear invasion by the armed forces of her powerful eastern neighbour. About this same period, Germany provided evidence of the closeness with which she kept watch on the external policy of Belgium. During the Boxer rising Belgian interests in China were threatened, consequently, on the initiative of the burgomasters of four of the large Belgian towns, steps were taken to form volunteer corps destined for service in the Celestial Empire. Thereupon Germany protested with considerable energy that the adoption of such measures of protection were forbidden to Belgium owing to her status as a neutral power. Belgium accepted the German view, in spite of the fact that by doing so she imperilled the position of her political and national representatives: she believed, however, at the time that, as some sort of compensation, she had obtained strong and certain evidence of the lengths her powerful neighbour was prepared to go in fulfilment of the obligation undertaken by her to see the neutrality of Belgium strictly observed. Later, it was thought, further evidence of this intention was forthcoming with still greater clearness during the course of the wrangle raised, in 1911, in connection with the Dutch proposals to fortify Flushing. At that time certain newspapers had suggested that in the event of a Franco-German war, in the near future, the neutrality of Belgium would be violated by Germany. The question of Germany's intentions was taken up by the Belgian Foreign Minister with the Imperial Chancellor; the former suggested that a declaration on the subject in the Reichstag, on the occasion of a debate on foreign affairs, would have a reassuring effect on public opinion. To this suggestion von Bethman-Hollweg replied, as will be seen from the Belgian Grey Book, that he well understood the sentiments which had inspired the Belgian Foreign Minister, but he could not accede to the request, declaring, at the same time, that *Germany had no intention of violating the neutrality of Belgium*, but if such a declaration were made publicly Germany would weaken her military position, so far as France was

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concerned. Attention is drawn to a speech made on the 29th April, 1915, by von Jagow, the German Secretary of State for Foreign Affairs, at a meeting of the Budget Committee of the Reichstag, and reported in the *Norddeutsche Allgemeine Zeitung*. In this speech occurs the declaration: "The neutrality of Belgium is determined by International Conventions; Germany has decided to respect the provisions of these conventions." It is reported that, on the same occasion, in the course of a reply to a member of the German Social-democrat party, the German War Minister said: "Germany will not lose sight of the fact that the neutrality of Belgium is guaranteed by international treaties."

In spite of the assurances contained in the speeches referred to, it would appear that certain incidents connected with European politics created deep misgivings in the minds of those responsible for the government of Belgium. Similar misgivings prevailed in the Chancelleries and in military circles in certain European capitals; it was felt by the well-informed that the outbreak of a European war was imminent and inevitable. To complete the chain of evidence, Belgium had received, in 1912, from King Charles of Roumania, a ruler tied neither to the Triple Entente nor to the Triple Alliance, friendly advice cautioning her to keep watch on the defences protecting all her frontiers. "The miracle of 1870," said this monarch, "will not be repeated: Belgium is in great danger of seeing her neutrality violated by one of its three neighbours." Other warnings were also received; evidence of a confirmatory nature was forthcoming from German sources that the invasion of Belgian soil was occupying the mind of at least one nation. In his work, *Deutschland und der nächste Krieg*, von Bernhardi had written: "No natural obstacle, no powerful fortress stands in the way there (*i.e.* in Belgium and in Holland) to prevent a hostile invasion, *neutrality is but a rampart of paper*. In the south also, the barrier of the Rhine can be turned by pushing through Switzerland."

King Albert visited Germany in November, 1913; the Kaiser did not hide from him the gravity of the political situation in Europe and declared that it was becoming difficult for Germany to avoid war with France. If war came there was no doubt, in the Kaiser's mind, that the German arms would triumph and carry victory before them.

In his work Waxweiler states that the Belgian Ambassador in Vienna transmitted the text of the Austro-Hungarian ultimatum, about to be addressed to Servia, to the Foreign Office at Brussels on the 24th July, 1914. The Ministers of King Albert took necessary measures forthwith to provide against the contingency of a European conflagration. On the 31st July following, the French Ambassador at Brussels showed the Belgian Minister for Foreign Affairs a telegram, emanating from the Agence Havas, announcing that a proclamation had been issued in Germany creating the *régime* known as *Kriegsgefahr*. At the same time, the French Minister gave the assurance that France would respect the neutrality of Belgium. The various incidents which preceded the irruption of German hordes into Belgian territory are set out in detail in this number of the *Revue*. Germany was no longer ready to give any kind of undertaking that she would respect the neutrality of Belgium, nevertheless, on the 2nd August, 1914, the

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German Ambassador in Brussels called at the Belgian Foreign Office and secured the assent of the Belgian Government to his request that facilities should be given for the conveyance, over the Belgian railways, of German reservists, residing in Belgium, who had been recalled to the colours. The only reserve made by the Belgian Foreign Office was that a similar concession would be made in favour of French reservists recalled to the colours. At this announcement the German Ambassador made the remark: "That you must look after yourself, *but you well know that so far as matters concern us you may have every confidence.*"

The Belgians were put off their guard and even the Brussels Press was duped. On the date last mentioned, the German Ambassador at Brussels gave an interview to a representative of *Le Soir* and alleged that Germany had a friendly feeling for Belgium, summing up his views in the phrase: "Perhaps the roof of your neighbour's house will be set on fire, but yours will be safe enough." On the same day, Capt. Bringmann, the German military attaché (at Brussels), called up the office of the editor of *Le XXe. Siècle* on the telephone and requested a categorical denial to be published to the statement, then in circulation, that Germany had declared war on France and on Russia. The conversation which took place is recorded. The Editor asked the military attaché whether German troops had not invaded and occupied the Grand Duchy of Luxemburg. Capt. Bringmann appears to have gone through the form of ascertaining how matters actually stood; on the completion of this fictitious enquiry he returned to the telephone and gave, what can only be described as, an evasive and deceptive reply.

The staff of the two papers *Le Soir* and *Le XXe. Siècle* were completely deceived; consequently, on Sunday, the 2nd August, 1914, these papers, on the faith of the categorical declarations made by German officials holding important positions, published announcements of a reassuring character regarding the international situation.

It was after these interviews had taken place that, on this same Sunday, the 2nd August, the German Ambassador at Brussels called on the Belgian Minister for Foreign Affairs and placed in the latter's hands the demand which astonished the world, calling on King Albert to give an unopposed passage through Belgium to the German armies. The text of this demand is given in the *Revue;* the Belgian Government was allowed, as is well known, 12 hours in which to reply thereto.

If now the mind is carried back to the story of the Austrian invasion of Switzerland in 1813, it will be observed that the interval of a century has not brought about any appreciable change in the procedure which finds favour with the violator of neutral territory: he has, perhaps, become a little more crafty, that's all. The telephone had no existence in 1813; but there was, in that year, the employment of a ruse to throw a neutral people off their guard; the preparation of a stealthy "coup de force" under cover of this ruse; the delivery of an ultimatum giving a sufficiently short period of time for the delivery of a reply, so as to remove all possibility of a proper consideration being given to the question; lastly, as the guiding principle of so much duplicity practised under cover of the pretext of very exceptional circumstances, the doctrine was openly espoused that the needs of strategy were

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superior to solemn obligations deliberately entered into by treaties. It will easily be recognized that the programme of 1914 is a close imitation of that of 1813: von Bethman-Hollweg has nothing to be envious of in Metternich; the younger von Moltke has nothing to learn from von Schwartzenberg.

One lesson appears to be taught with perfect clearness by the above comparison: A little nation has no other guarantee of existence or other security in its pursuit after peaceful progress than that provided by the moral force which is based on the intention to recognize *Right*.

If in August last, says the *Revue*, it had been a question of marching German armies on Lyons instead of on Paris, then it would have been the violation of Swiss territory, which Waxweiler would have described in a work dealing with a premeditated invasion. In this case also, he could have discovered, in the recent past, affectionate toasts for republication, suggestions moreover of well-merited confidence in a people and their rulers; probably a firm belief too, in some minds, of the desire on the part of powerful neighbours to respect Swiss neutrality, which belief rumours of the existence of tortious intentions could, in no way, have decreased. Who knows, he may even have been able to discover suave telephone conversations on the part of high-placed officials with editors of newspapers.

It is suggested that Switzerland would, in the case of a German invasion, have suffered more than Belgium. In a situation similar to that in which the forts of Liège were found, there would have only been a few companies of Landsturm echeloned along the frontier; no serious obstacle would have presented itself to prevent the Uhlans being pushed rapidly into Zurich; there these doughty warriors could have cut the railway communications, deprived one-third of the Swiss Army of its supplies, and the Confederation of its most up-to-date factories and its most high-developed industries. It is the desire on the part of the Swiss to escape the experiences of the Belgian people that has, no doubt, inspired the concluding prayer: "Let the peace yet to be consummated bring about the triumph of Right over the abuse of Might."

Explosive and Dum-Dum Bullets.

An article was published in the number of the *Revue*, for February last, which seemed to leave no doubt that the accusation levelled against the Austro-Hungarian troops concerning the use of explosive bullets, against the Serbians, was only too true.

The *Revue* states, in its May number, that it has repeatedly come to notice that explosive bullets have been used in the western theatre of war. Reference is made to the wounds received by a French soldier of the 152nd Infantry Regiment in August last, a photograph of the wound being reproduced; in this case there is evidence that the wound in question was inflicted by an explosive bullet discharged from an American sporting rifle by a German officer. There are grounds for believing that in the other cases where wounds have been caused by explosive bullets to soldiers fighting in the western theatre of operations, such bullets have been discharged by German and not by Austrian troops. Although

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the German communiqués have admitted that the German army operating in Belgium has borrowed copiously from the artillery of the "Brilliant Second," on the other hand, no evidence of any kind has been forthcoming tending to prove that the Austro-Hungarian infantry or cavalry have fought anywhere on the front, Basle to the North Sea.

The *Revue* states that the use of dum-dum bullets has also been proved, and points out that a bullet of hard metal such as the regulation French D bullet cannot be converted into an expansive bullet, whatever be the nature of the mutilations it may be subjected to. However, articles, with illustrations, have been published, on frequent occasions, with the object of proving that the D (Lebel) bullet had been converted into the dum-dum pattern. The bullets in use in almost every other European army than the French can be readily converted into the dum-dum pattern and illustrations are given, in the article, of the dum-dum bullets which, according to official reports, have been used by the Germans during the present War. Illustrations are also published which show the nature of the perforations made in walls of damp clay by an ordinary lead bullet provided with a hard metal envelope, and the same bullet converted into the dum-dum pattern. Further, attention is drawn to an article which appeared in *La Nature* of 12th December last, wherein reference is made to a very simple method employed by the German infantry to convert the regulation bullet into the dum-dum pattern. It also appears that the *Berliner Illustrierte Kriegs Zeitung* (No. 15) and other German papers contain illustrated articles showing, what they allege to be, the mechanism fitted to the British rifle, for converting the regulation ammunition into the dum-dum pattern, "in three motions." Another illustration, not reproduced from a German source, shows what would actually happen if it were attempted to carry out the alleged dum-dumming process in the manner indicated.

PROPOSALS RELATING TO THE ARMAMENT OF CAVALRY.

In the first five months, during which the Swiss Cavalry had been mobilized, certain matters in connection with the arms and equipment of this branch of the service requiring urgent attention have, according to the author of the article, come to light, as follows:—

I. The Swiss cavalry require to be mounted on a better stamp of troop horse. The cavalry armament also needs modification; a mounted patrol of Swiss cavalry, armed with the sword only, coming suddenly into contact with an enemy mounted patrol, armed with the lance, would, in the author's opinion, be caught at a disadvantage. A Swiss cavalry soldier when separated from his horse is without a weapon of defence; it is recommended that revolvers should be issued to the cavalry.

II. The method of carrying the carbine is discussed. Reasons are given for the carbine bucket being attached to the saddle on the near side of the horse and the sword and mess tin on the off side.

III. The present War has shown that cavalry may, at times, be called upon to perform infantry duties. On such occasions, a bayonet often comes in very useful, but as the issue of this weapon would, in the

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author's opinion, carry with it a loss of mobility and also destroy the cavalry spirit he recommends that the present cavalry sword should be slightly altered and provided with attachments enabling it to be fixed to the carbine for use as a sabre-bayonet (the proposed method of attachment is shown by means of a sketch).

Notes and News.

United States of America.—A special correspondent writes on the subject of military organization and points out that the citizens of the great Republic are divided into three camps on this question: The pacifists, they are most obstinate and will not dismiss from their minds the chimera with which they have been obsessed in the past; the progressists, they are much in evidence and desire a serious increase in the military forces of the Republic; between these extremes stand the "hesitants," the *statu quo* is good enough for them, subject however to the proviso that the youth of the country be made to undergo a "thorough" military training during the period spent at school. It would appear that the pacifists, instead of being completely nonplussed by the brutal blow struck at their pet theories during the past few months, are infinitely more obstinate and more blind on the American Continent than those of their ilk in Europe; it is suggested that this may be accounted for by the fact that the former are further removed than the latter from the material evidence of the bankruptcy of anti-militarism. The pacifists have endeavoured to bring pressure to bear on President Wilson and have prayed him to intercede with the belligerent powers in order to obtain a general disarmament. It is suggested that they form a dangerous class, since certain of their arguments, specious in themselves, are of a nature to impress the public and Congress, when brought forward by men much in public evidence, such as Carnegie, Bryan and Daniels (Minister for the Navy). It is shown that want of military preparations has not prevented the United States of America from being involved, in the past, in military operations; the only result of the policy of "petits armements" has been to inflict unnecessary loss and suffering on the troops and to jeopardize the success of their operations. Nevertheless, the Utopianism of Carnegie and of Bryan has captivated many members of the American Congress.

The progressists are led by General Wood, ex-Chief of General Staff, and now G.O.C. Eastern District, some Congressmen, including Hobson (a hero of the Spanish-American War), and Garrison, the Minister for War; this class naturally desires considerable improvements to be effected in their country's military system. Unfortunately, the progressists are not unanimous as to the methods to be employed to attain the ends desired, some advocate the formation of new regular units, others desire to see the National Guard increased to double its present strength, whilst a third group restricts itself to a recommendation that a system of strong reserves should be instituted. It is suggested that this class is too lazy to devote its time to the thorough examination of the problem under consideration but limits its attention to "faits accomplis."

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such as the "American Legion" recently formed. The Legion is a non-official institution; however, its formation has given umbrage to the pacifists and especially the "League for the Limitation of Armaments." The pacifists attacked General Wood for giving official countenance to a private institution, in that he had permitted his A.D.C. to act as an adviser to the Legion. It appears that the Minister for War has passed a mild censure on the General, but the letter conveying the censure discloses the fact that the Government is disposed to give the Legion official recognition and to incorporate it into the army system as soon as the Legion is constituted on a sound basis. The hesitants, when recommending preliminary military training of the youth of the country during their school days only, appear to lose sight of fact that the object of such training is to habituate lads to military discipline and to facilitate the practical training at the recruit stage: practical training during the years of manhood is held to be essential for the development of the recruit into an efficient soldier. The special correspondent is of opinion that the opening of the Panama Canal has complicated the problem of national defence under present circumstances; an examination of the situation leads him to the conclusion that the protection of the Canal zone proper—15 km. (about 9 miles) wide and 75 km. (about 46 miles) long—necessitates the detaching of 3 infantry regiments, 4 squadrons of cavalry, 1 brigade of field artillery and 18 companies of garrison artillery for this specific purpose, and incidentally involves an increase in the mobile troops detailed for the defence of Hawaii, the garrison of which should then, exclusive of the garrison artillery, be raised to 6 infantry regiments, 1 cavalry regiment, and 1 regiment field artillery; thus raising the infantry and field artillery units which would be immobilized in connection with the defences of the Panama Canal to 9 infantry regiments and 12 batteries of field artillery.

After many years of peace the Red Indians of Utah have recently given trouble; they have been assassinating members of one of the other tribes. The maladroit handling of the situation by the magisterial authorities exasperated the situation, and by degrees the whole region was in a state of effervescence. Instead of dealing with the situation in the usual way, that is by the despatch of a punitive military expedition, General Scott, Chief of the General Staff, made his way to the camp of the revolters accompanied only by an A.D.C. and an orderly. The General is known to the Indians by the name, "The white-man who-stoops-not-to-tell-lies"; it sufficed for him to assure the disturbers of the Pax Americana that equity and good conscience alone would guide the judges, who would try them, in arriving at a decision as to their guilt or innocence. Knowing, as they did, that the offence with which they were charged involved a death penalty on conviction, nevertheless the assurance of the General of a fair trial caused the revolters to surrender themselves into the hands of the judicial authorities.

It is stated, on the authority of General Wood, that the colour adopted for the new campaigning kit of the German Army was borrowed from the American Army. American officers, attending the German manœuvres recently, decided one day to wear their service kit. Their appearance in such a practical outfit is said to have created a veritable

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sensation in German military circles; the German officers were converted to the innovation at once, but the Kaiser pronounced against it, arguing that the dull uniformity would militate against *esprit de corps*. A press campaign followed in favour of the change and the Kaiser capitulated.

France.—A correspondent discusses the problem of the tactical offensive and defensive. He states that, according to his information, Colonel Hubert, of the Swiss Army, recently addressed a copy of a brochure to the President of the Swiss Confederation, which the former is publishing in Paris under the title, "The Present War," but this copy did not reach the Chief Magistrate of the Helvetic Republic. Colonel Hubert's work deals with the strategy and tactics of the first eight months of the War and is written with the spirit of impartiality desirable in a neutral. It is pointed out that the opinions of military writers on the relative merits of the offensive and the defensive have frequently undergone a change on the conclusion of an important campaign. The resistance offered to the British arms by the Boers led to the defensive being considered superior to the offensive; whilst the success of the Japanese armies against the Russian masses caused opinion to swing to the opposite view.

Reference is made to General Foch's work, *Principes de Guerre*, and an extract therefrom is published wherein the General states, "Improvements in firearms bring an increase of strength to the offensive, to the attack intelligently conducted; history affords examples of this, and a logical examination explains the reason for it." And he proceeds, by a mathematical statement, to demonstrate the accuracy of his views on the subject. Colonel Hubert apparently attacks the above-mentioned mathematical treatment of the subject and refutes the accuracy of the General's deductions, but in order to do so ignores the postulate on which the calculations, in the case mentioned, are based, namely, the superiority of the numbers employed in the attack as compared with those on the defence. In his own work, Colonel Hubert claims that: "The absolute theory of the tactical offensive, in all cases and at any price, has cost the French as well as the German Army the flower of the youth in their first line troops, both in officers and in men." That is to say, this theory has proved disastrous in the present war. The Colonel is a firm believer in the defensive and states: "It is not impossible, when time is available, to cover one's front with field defences on a front of 100 leagues (*i.e.* 250 miles) as promptly as did Wellington formerly on a front extending over 10 leagues only. It is this circumstance which throws light on the singular characteristics developed in the present war since last autumn."

The defensive has at the present hour become so powerful that pronounced salients are to be found in relation to the fronts occupied by one belligerent and the other; salients which are practically enveloped by the enemy's artillery and machine-guns, and these engines of warfare, in spite of their power for destruction, do not manage to wipe out the troops in the salients or cause them to surrender: such are the positions familiarly known as the "Wart" of Dixmude; the "Knob" of Arras; the "Hernia" of St. Mihiel. To the great wonderment, not only of

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the non-expert but of the expert also, Rheims, an open city, Soissons, a small town without importance, remain impregnable in spite of the incessant rain of shot and shell poured on them by the German artillery.

Colonel Hubert's opinions bring to mind the discussion contained in General Percin's work, *Le Combat*, in which the General examines the same question under the title "*Offensive ou Défensive*," with such great impartiality as to leave the reader in doubt as to the side to which he inclines. The Colonel's view seems to be that the Germans have made a mistake in following up their strategic offensive with a tactical offensive, instead of resorting to the tactical defensive after their preliminary successes. Accepting this as a basis for a further examination of the subject, he concludes that, in order to obtain success, it is necessary that centralization of command should cease; concentration of authority, although good for a war of manœuvre, is not, he thinks, desirable in a war of immobility.

General Percin holds that the adoption by the Frency Army, just prior to 1870, of the doctrine, "with the new arms of the day, the advantage has gone over to the defensive" proved fatal to it. The General points out that "The defensive is a form of combat which, even where the intention clearly exists to assume the offensive, must often be resorted to without choice. This will not be the "*défensive généralisée*," admissible only to a side which is notoriously inferior in material and moral forces; in such cases it will be the "*défensive localisée*" which will be assumed along certain portions of the front, permitting troops to be economized for a vigorous attack at other portions of the line of battle.

It will not be a defensive assumed by choice or one long premeditated, but rather "a defensive imposed by force of circumstances on some fraction of an army which is not in a position to deliver an attack. . . . The defensive is not an inferior form of combat, reserved for troops of mediocre quality and for chiefs of weak character. The defensive demands, on the contrary, energetic chiefs and trained troops."

To sum up, General Percin rejects *in principle* the "*défensive généralisée*," in order to advocate alone the "*défensive localisée*." In the present war, it is the "*défensive généralisée*" which has established itself on the western front.

Portugal.—A special correspondent points out that international questions are the order of the day, and the world is so disturbed that even the most peacefully minded nation does not know whether, at any moment, it may not be called upon to enter into the great conflict of arms now in progress. The Spanish Press appears to have added fuel to the flames by reviving a discussion on the classic theme of the absorption of Portugal into Spain by force of arms, just at a time when the latter country had summoned a contingent of 30,000 men to the colours and recalled to Europe a considerable portion of its army which had been operating in Morocco. It is stated that history has shown how grave a mistake was made by Spain in 1580, when she annexed Portugal and exercised a violent and arbitrary domination over the country; during her reign of 60 years, she did not succeed in making Portugal a Spanish province. The correspondent continues: "We do

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not constitute an artificial nationality; there is not, in Europe, another people amongst whom the idea of 'la patrie' is more highly developed. Our race, geography, history, religion, jurisprudence, all these form a characteristic *unité morale* amongst nations; these qualities, moreover, have grown up by a process of spontaneous evolution. It is this *unité* which we possess and that distinguishes us so markedly from other peoples; that is the reason that our race cannot be blended with other races nor even assimilated by them. . . . We have confidence and do not fear, for the moment, the phantom of the '*Spanish peril*'."

The almost unanimous insistence of the Spanish Press on the exchange of diplomatic notes between the two countries made it necessary for the Portuguese Minister for Foreign Affairs to make formal and categorical declarations on the subject; these declarations dissipated the doubts existing in the minds of the Portuguese people and public confidence was again restored. Meanwhile, the friends of Portugal in Spain and a certain section of the Press in the latter country immediately entered the lists in defence of Portugal. The Spanish Minister for Foreign Affairs himself intervened and declared, *inter alia:* "The events of which Portugal is the theatre and the questions which affect that country cannot leave Spain indifferent. . . . Spain has herself considerable interests in the maintenance of peace in Portugal and in the prosperity of that country; the Spanish Government, above all things, must adopt measures to destroy the ridiculous fairy-tales attributing to her hostile intentions or ambitious designs against her neighbour." The opinion is expressed that the propaganda referred to as the "Union ibérique," is the ambitious and chimerical dream of certain light-hearted politicians and does not constitute a national aspiration in Spain. The existence of the Portuguese Republic neither inconveniences nor menaces her neighbour, similarly Spain neither incommodes nor threatens Portugal.

No. 6.—*June*, 1915.

INDEPENDENCE AND NEUTRALITY.

Le Devoir Suisse.

This article is headed by an extract from Pictet de Rochemont's *De la Neutralité de la Suisse dans l'Intérêt de l'Europe*, published in 1821, in which he has some words of advice to offer on the subject of Swiss neutrality; in this extract, *inter alia*, the statement occurs: "It is necessary in order that *this neutrality may be real, effective and firm* . . . that there should never be any secret influence in the Republic's councils of a nature to give rise to a suspicion of partiality or to disquietude regarding its consequences, at the supreme moment when this neutrality is put to the test. The true policy for Switzerland to adopt consists in serving, turn about, as a shield for its neighbours, in cultivating their good will so long as this does not involve loss to its dignity." The writer of this article, taking the extract as a text, deals with the division of opinion in Switzerland on the question of the War. He frankly admits that he holds views in opposition to those held by the French-Swiss and their representatives, nevertheless, having been offered the hospitality of the

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columns of the *Revue*, he takes advantage of the offer, since he considers it a privilege to defend unpopular ideas. He expresses the opinion that, in the French regions of Switzerland, some are going too far in their partizan attitude on the subject of Right and of Justice, however necessary and justified it may have been at the beginning of the War to have taken up a stand against the German peril. If care is not taken to curb this partizanship, he fancies that, under the pretext of being neither Prussian nor, for the matter of that Bernese, some there are who run the risk of gently sliding down a slope until they find themselves, without warning, not even Swiss; the conduct of these partizans, it is feared, will lead them into spoiling a good cause. The writer points out, in his article, that in the years from 1798 to 1814, the schism in Switzerland was much wider than that existing at present; but time passed, history sat in judgment and justice was done to the grand patriots on both sides. These patriots may have been divided in ideas, by sympathy, age, even by their acts: what mattered that if, after all, they remained one at heart.

Reference is made to the founding of the "*Nouvelle Société Helvétique*" in January, 1912, and to the circular issued at the same time. Extracts are given from the circular; it dealt with the internal dangers of Switzerland and drew attention to the serious international situation, pointing out that the outbreak of a European conflagration was imminent, there being 99 chances to 100 that Switzerland might be involved. It was asked whether the country was ready to face the crisis; what was to be its attitude, surrounded as it would be by belligerent nations? What was to be done, whose advice was to be listened to? It was pointed out in the circular that, in practice, the Swiss might find it difficult to act in conformity with the duty imposed by the juridical position of Switzerland as a neutral state. It was recognized that neither a perfect organization, nor a strong army, nor excellent institutions were in themselves sufficient, but that behind the army that fights, behind the authorities who direct, there is wanted the *esprit publique* capable of inspiring and sustaining them both. The development of a patriotic sentiment was required which would lead the people in the hour of danger to say: "*We desire to remain Swiss, we and our descendants.*" The "*Nouvelle Société Helvétique*" had but one object, namely, "to strive, by the union of the Swiss, particularly in matters tending to divide them, for the maintenance of the dignity and the security of the country." In performing this task the *Société* afforded, at least, an example of the "*devoir Suisse*"; in the case of the individual what is wanted to attain the same end is "*une attitude personnelle.*"

The "*devoir Suisse*" should consist, in practice, of a series of small precise daily duties; these may, in appearance, be wanting in heroism, but they demand virtues which are rare, such as stoicism, prudence, tenacity, etc. The present War came as a surprise to the great majority of the Swiss. The scenes of July, 1914, are described; the mobilization of the army; the flight of the tourists; the panic of the civil population; the terror of an invasion. The order and quietness with which the Swiss Army was mobilized reassured the public. Everyone later became patriot and militarist and only insisted on the right to fight against a

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possible invader, whoever he might be. This was the second stage: the period of *nationalisme exaltée.* The danger of an invasion had apparently passed away; Switzerland was then forgotten, but the interest in the belligerents remained. All fear having been dissipated, some began to take sides and allowed themselves to be dominated by their sympathies, their affinities of language or of race. Suddenly the command was heard: Be neutral. On this there followed the third stage, a weakening of national sentiment and divisions of public opinion. It is stated that at one time these divisions of opinion had grown to such dimensions in Switzerland that many staunch patriots became seriously alarmed. Excesses gave birth to a reaction and many commenced to work in the cause of national union. Thanks to these efforts a sincere and durable *rapprochement* between the Germanic and Latin parties of Switzerland took place. National duties, such as those inaugurated by the "*Nouvelle Société Helvétique,*" reawakened the Swiss spirit, whilst international enterprises such as Red Cross work toned down hatred, strengthened the European spirit, the sense of justice and of humanity. Thus it was that the fourth stage was reached: that of the "*réaction salutaire.*"

An attempt is made to discover the *causes profondes* of what has passed. It is pointed out that war exalts man's caprices; it develops heroism, but it obscures the intelligence, unchains passions and the primitive instincts of man. It was natural then that the violation of Belgian neutrality should have caused a wave of indignation and reprobation to pass through Switzerland; indifference in face of the facts brought to light would have been blameworthy.

It is stated that the first lesson the War has taught the Swiss is the fact that they are still dominated by foreign influences, and that they are still lacking in an *opinion publique,* an opinion guided by the sole principle: the general and paramount interest of the Fatherland. It is recognized that public opinion will, as a rule, only form round some central idea; in the case of the Swiss it should be—the idea of Switzerland itself, its independence, its neutrality. Owing to defects in the national system of education this idea is to many Swiss, vague and obscure. It is asserted that never has more tomfoolery been talked on the subject of neutrality than has been the case in Switzerland since the beginning of the War. The majority of the people are ignorant of what it consists, and, above all, of their duties in relation thereto. So much so indeed is this the case that, after the neutrality of Belgium and the Grand Duchy of Luxemburg had been violated, there were many Swiss who persuaded themselves that these facts in themselves afforded an efficient and formal guarantee that the independence of Switzerland, at all events, was thereby secured. The first reason given why Switzerland should remain neutral is that a duty is imposed upon her to remain true to her word and to show respect for the obligations entered into by her with the European Powers. The writer of the article argues that a Swiss individually violates the neutrality of his country each time he shows, either by act, word, or deed, direct hostility towards one of the belligerent powers in any openly public manner, or when his conduct in any way provokes a hostile incident. He does not agree

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that in a democracy, such as that under which the Swiss live, neutrality can be looked upon solely as a political attitude of the State. It is not possible, he thinks, to separate the individual from the State; even were this possible, it would, in his opinion, be dangerous to attempt such a separation. The second reason given why Switzerland should remain neutral is that the national interest demands the adoption of this course. There is still a third reason why Switzerland should remain neutral, it is dictated by the *esprit confédéral;* each member of the Confederation has a duty to fulfil towards the other members of the Republic, the duty of forbearance. The writer of the article expresses the opinion that it is the duty of those living under the Federal banner to treat the German-Swiss as the eldest son of the family. It is to this section of the community that Switzerland owes her separate existence, this section it is which has founded the nation.

AN OLD ARTICLE.

An anonymous article appeared in the *Revue* for May, 1902, in which an attempt was made to study the probable features of the next great war. At that time, people's thoughts were preoccupied with certain conceptions which differed so widely with the views expressed in the article referred to, that the majority of readers failed to grasp the author's meaning. The *Temps* has unearthed the article in question and republished it with comments, in its issue of 7th April last. The identity of the author has also now been disclosed; he is none other than Colonel Mayer, of the French Artillery, now in command of one of the Sectors of Paris. His ideas were in flagrant opposition to the dogmas of official orthodoxy, to the teaching of the "*École Supérieure de Guerre,*" to the views held at the "*Centres des hautes études militaires,*" to the accepted doctrines of the General Staff, both in France as well as out of it. The Colonel first published his ideas in the "*Bibliothèque Universelle*" of February, 1891, under the title "*Évolution de la Tactique*"; there he examined the developments likely to arise from the increase in rapidity of fire of the weapons in the soldiers' hands and from the introduction of smokeless powder. He wrote for the information of the general public and pronounced himself clearly opposed to the views of the theoreticians who argued exclusively in favour of the offensive. "Let us not give our support," he wrote, "to those who claim that the offensive has lost nothing of its value." He declared that the defensive was not, as some had said, "an attitude of which the whole strength resided in purely negative advantages. It had a virtue of its own." The Colonel foresaw that battles would no longer be fought, as a rule, on the open ground hitherto sought after, but that armies would henceforth progress "craftily in broken country, adapting in field warfare the practices of street fighting." He expressed the opinion that preparations for the new methods of war should be taken in hand "by a general reorganization of the army, by a different distribution of the combatant arms, by a complete remodelling of the weapons of war, by a radical transformation in the methods of command employed up to the present day"; he contributed many articles to the daily papers and to periodicals on the foregoing matters.

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The article referred to above was closed with the following warning: "Let us learn to be content with these vague indications. The Sibyl herself, if questioned regarding these disturbing secrets of the future, could reply in none but unintelligible words; her fragmentary dicta would alone convey ominous threats. A presentiment exists that something terrible is brewing and sure knowledge there is, alas! that the key to this enigma will alone be found in the blood of numerous victims." This article remained unnoticed. Colonel Mayer returned to the charge in the number of the *Bibliothèque Universelle* for April, 1902, with an article entitled "*Le Combat dans la Guerre Moderne.*" Subsequently, he decided to appeal to the members of his own profession and prepared an article for the *Revue*, taking advantage of a situation which had, at that date, risen in France owing to the publication of certain propositions by General de Négrier in the *Revue des Deux Mondes*, which had created a considerable stir in military circles. He wrote an article entitled "*Quelques idées françaises sur la guerre de l'Avenir,*" in which he associated his own revolutionary ideas with the views published by General Négrier in his contribution to the *Revue des Deux Mondes*. The Colonel called attention in his article to the fact that the French Army continued "to proclaim the superiority of the offensive" and "to rely on the moral effect of the bayonet charge"; he continued, "By the side of this doctrine which contains the official articles of faith, there is yet another doctrine now about to see the light of day. In the processes of the new war, it is prophesied, new formations will be utilized, ancient dogmas will be cast aside." A description is given by the Colonel of the plan of attack formulated by General Négrier, the characteristics of which consisted in the suppression of reserves, the disposition of troops in successive lines 1 league (about 2½ miles) in rear of one another, so that no risk might be run of blows aimed at the first line reaching the lines in rear; the General's idea being that a succession of waves of attack would roll on irresistibly against some one selected rock of defence, there either to break up themselves, or to pulverize and consume the rock. But in reproducing the General's plan, Colonel Mayer left no doubt in the minds of his readers that, in his opinion, it was highly improbable an attack could renew itself, in the manner indicated, against an opponent on the defensive in well-prepared positions. He stated definitely that, once the front of the attack had come into collision with the defences, trench warfare would, by the force of circumstances, have to be substituted for the war of manœuvres. Further developing his views, the Colonel gave a very realistic picture of the battle of the future; he spoke of the possibility of the use of torpedo-like shells, of the dropping of bombs by aircraft and the employment of new methods in war, hitherto unheard of, which, on account of their unknown origin, would produce bewilderment and surprise. The resemblance of the field warfare of the future to the siege warfare of the past was, in the author's opinion, likely to be very close indeed. His views can be summed up in the following terms:—The war of the future will consist of a "*combat défensif*" which will drag its painful course with alternations of very localized successes and very partial reverses, without producing any decisive

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results where the fighting is of a purely defensive character. So far as other troops, which may be available, are concerned they can best be employed in some other region, as far away as possible from this theatre of defensive warfare, where they should attempt, by their boldness, to shake the *morale* of the higher command. In the article of May, 1902, the opinion is expressed that the opposing armies would remain facing one another in their respective positions for an indefinite time; the operations of war would not cause the raising of the blockade unless, indeed, the diminution of supplies caused one side or the other to yield. It would be circumstances of an external nature, such as the exhaustion of financial resources, or the general political situation, which would terminate the War and even then this would happen without either belligerent having gained any marked advantage or having met with any decisive defeats. Nevertheless, it will still remain necessary to show foresight, calmness, boldness, and the true offensive spirit even on the defensive. More than ever before must the troops, the staff, the higher command and the civil population put forth all their energy. Still more than ever before will it be necessary for the generalissimo and those under his command to possess expert professional knowledge and experience.

NOTES AND NEWS.

Switzerland.—It is pointed out that, by degrees, the confusion which has existed in Swiss minds on many subjects is at last being cleared up: the confusion between neutrality and sovereignty; the confusion between international policy and the policy of conquest; the confusion between military and civil power; the confusion between a state of peace and that of war. It is stated that the consequence of so much confusion has been to render more and more difficult the task of the Federal Council; the breach between the citizens of German and those of French sympathies has added to the difficulties of the situation. It is urged that the situation cannot become grave if the Central Government will only take advantage of the resources of the federative system: what is wanted is closer contact between the citizens and the Cantonal authorities and less interference by the bureaucracy. Regret is expressed that the equilibrium previously existing in the Federal Council between the two most important Swiss Communities was disturbed just prior to the outbreak of the present War. Turning to another question, it is considered to have been a serious mistake to have placed the censorship, in peace time, under the military authorities, as this has caused the army chiefs to be reached by public criticism; it is felt that it is not too late, even now, to place the censorship in civilian hands.

INFORMATION.

Switzerland.—The new grey-green uniform adopted for the Swiss Army is described.

This number concludes with a bibliography of literature of interest in military circles.

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THE SUPPLEMENT.

"The European War" (*continued from the* R.E. JOURNAL, *June*, 1915).—The third part of the *Supplement* on "The European War" is published with the April number of the *Revue*. The opening paragraphs relating to "The Battle of the Aisne" appeared in the second part of the *Supplement;* the account of this battle is continued in the third part and is dealt with under four subheads. The first of these subheads is entitled "The Commencement of the Battle in the Light of German Telegrams." The situation, from the German standpoint, during the opening phases of this battle is disclosed in three telegrams dated 14th, 15th and 16th September, 1914; these telegrams announce that the engagement, which commenced on the German right wing on the 13th *idem*, had extended eastward until it had involved the German troops in the neighbourhood of Verdun. Attention is drawn in the *Supplement* to the fact that all references to the Battle of the Marne had been slurred over in the earlier German communiqués and that a *lacuna* existed in the series of German war telegrams (*i.e.* covering the period 3rd—14th September). In a German telegram of the 16th September, it is claimed that French attacks had been repulsed and that German counter-attacks had been crowned with success. On the following day, a German official telegram gave hopes of victory; it said, "Between the Oise and the Meuse, the battle still continues but there are indications which lead to the conclusion that the resistance of the enemy is weakening. On our extreme right the enemy has attempted to break through our lines. This attempt, although carried out with considerable enterprise and great bravery, has finally broken itself spontaneously, and without any pronounced effort being made on the part of our troops. The German centre gains ground slowly but surely. French sorties from Verdun, on the right bank of the Meuse, have been easily repulsed." In publishing the foregoing official telegram (sent to the Press on the 18th September) Wolff's Bureau added the following non-official *postscriptum*:—"The Great General Staff has good grounds for expecting that decisive results will follow to-day from the battle."

Before midday on the 18th September, and in continuation of the information of the previous evening, the German Great General Staff announced the "*decisive*" defeat of the 13th and 14th French Corps and parts of another division south of Noyon (the French Headquarters immediately contradicted this report). In spite of the success claimed, the German hopes of the previous evening were not realized. On the 21st September, the seizure by German troops of the fortified heights of Craonne and the reoccupation of Bétheny, near Rheims, were announced. The text of the German telegrams sent out between the 19th and 28th September appear in the *Supplement*. The general impression created by the accounts contained in these German telegrams is that a battle of moderate dimensions, confined mainly to the German right wing, had taken place, but that, in spite of the claim of "*decisive*" results having been obtained, things were really stationary. Further, apart from the successes claimed for the German attacks at Noyon and Bétheny, the battle is described as having been due to the initiative of

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the Anglo-French troops. The second subhead is entitled "The Commencement of the Battle in the Light of French Telegrams." The French accounts give more details than do the German. The fact is the German Press found itself in a false position; it had somehow to reconcile a defensive-offensive situation with one preceding it, which had been out and out offensive, and no sufficient excuse existed for the omission to refer to the transition phase. The French Press was more at its ease; after the Anglo-French success on the Marne, it had drawn attention to the fact that, during the German retirement, the enemy had offered resistance to the Allied columns in pursuit. It had also announced that a new battle was in progress and had given a clear account of the same. Further, the French General Staff was also free from the embarrassment probably experienced by the German General Staff, owing to the equivocal nature of the latter's account published with regard to the fight on the Marne. The German check on the Marne had probably been held to be a temporary accident, unfortunate certainly, but easily reparable. The text of the communiqué of the 15th September, explaining the situation at Noyon, Soissons, and to the north of Verdun is given, as also the text of the French telegrams, dated 17th, 18th, 20th and 21st September, which describe the succeeding tactical phases of the battle; these telegrams show the general character of the fluctuating events of the engagement which continued up to the end of this month. A comparison of the accounts given in the two sets of telegrams, the German and the French, appears to disclose the progress of two different battles, so dissimilar are these two accounts. The German version tells first of an offensive which throws the enemy on his defence, then the latter, in spite of the difficulties of the attack, resumes his offensive efforts; however, the Allied forces are broken up on coming into collision with the German armies which had eventually assumed an attitude, more or less, of a defensive character; the French account speaks first of an offensive also, but admits that the defensive was assumed, between the 18th and 24th September, in face of the enemy's activity whose attacks were renewed, time and again, without cessation. A communiqué of the 24th September is published in which the features of the fighting on the Marne and the Aisne are briefly compared. The third subhead is entitled "The Two Official Versions." It is pointed out that, of the two accounts, the French was the one least likely to throw dust in the eyes of the public. The French account leaves the door open to the announcement of a success, but makes it clear that patience is required and that the realization of the hopes awakened by the victory of the Marne must be postponed. Full credit is given to the enemy for his vitality, and no doubt whatever is left that the enemy is far from being destroyed yet. It is further pointed out that in the fighting on the Aisne there were not so few fluctuations along the battle front as the German version would lead one to suppose. Attention is called to the doctrines relating to the defensive laid down in the German regulations and to the fact that the French version of the fighting represents the progress of events as having more closely followed the teachings contained in these German regulations than does the German version. Again, it cannot be believed that, in the middle of September,

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1914, after only six weeks of hostilities, the German higher command had renounced its intention to destroy the forces of their opponents, the very objective of its strategy; the more so, in view of the general situation which required that France should be disposed of early, so as to free the German hosts for the campaign in the east. These two motives, added to the principles laid down in the official military doctrine, lead to the conclusion that counter-attacks in force were resorted to as the surest means of reaching the desired goal. The earlier German communiqués themselves lend truth to this view; they give rise to the hope, if not the conviction, of Headquarters that victory was in sight, on the fifth day after the assumption of the defensive. Everything, even the German version, leads one to the conclusion that the French version most accurately represents the true situation in relation to the events on the Aisne. The fourth subhead is entitled "The Amplified German Version." In it attention is drawn to an official note published in the *Norddeutsche Allgemeine Zeitung*, the object of which was to calm the public mind, in view of the disquietude created by information from foreign sources. The note hinted that the public had become spoilt owing to the surprising progress made by German arms in the first days of the war. The Great General Staff, it claimed, had not, like the non-combatants, committed the serious fault of underestimating the value of the French Army. Under this subhead, an examination is made of the notices relating to the War published by the German Press, and the conclusion is arrived at that these notices provide fresh evidence of the truly scientific nature of the organization created in Germany for the manufacture of equivocal accounts of the doings of the German Army. Several of the German communiqués are published in this part of the *Supplement*. In communiqués dated 16th September, information is given connecting up the events on the Aisne with those on the Marne. It is claimed therein that two German Army Corps had crushed five French Divisions; the Anglo-French forces had been pushed back across the Marne on to Paris, etc. Other telegrams dated 18th and 21st September are also reprinted. The story now told causes the progress of events on the Aisne to fit in with the German doctrine of war, and the *lacuna* in the series of despatches, that between the 3rd and 14th September, is filled in. The public are told to have patience; not to believe the lies being published abroad; to have confidence in their leaders who, it is claimed, are telling the truth. This amplified version produced the desired effect, the public was completely reassured; more than that, they felt that so far as France was concerned her game was up; and at the beginning of October, the belief was very prevalent that the French Army was completely out of action. The later German version clears up the contradictions in the French and German official telegrams despatched since the 22nd September. In the case of the telegrams of the former, whilst lulls in the fighting were referred to, it was stated that a battle was in full progress, with "German attacks of unheard-of fury"; the telegrams of the latter, on the other hand, spoke of the engagement as being finished and of a victory already won. It was alone required to complete the success so far obtained.

Under the title of "The Episode of Saint Mihiel," an account is given

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of the capture, on the 25th September, of the "Camp des Romains" by the Germans. In view of the magnitude of the operations on the western front, this development can but be considered to be an incident of minor importance. The German General Staff, having determined to force a passage through the French line in the neighbourhhod of St. Mihiel and thus to reach the Meuse, brought up a considerable artillery force under cover of which they made themselves masters, on the 21st September, of the foothills at Vigneulles-lès-Hattonchâtel and at Creue. On the 25th September, the Germans effected a breach in the northern rampart of de Rivière's line, captured the "fort du Camp des Romains" and established themselves at Chauvoncourt, on the left bank of the Meuse. The French delivered a vigorous counter-attack from Toul, this arrested the German offensive towards the west at this point and later caused the Germans to retire; within a few weeks the latter were back again on the right bank of the Meuse. The official accounts of this affair are set out in the *Supplement*. Both the French version and the German one, relating to the Saint Mihiel episode, are symptomatic of the methods of the press services of the two countries. On the French side, the main lines of the incident are precisely indicated, as also the results obtained, but so far as the partial reverses are concerned immediate news of which might create a disquietude out of proportion to the true significance of the event, references to them are postponed to a more opportune occasion. Further, silence on the subject of the capture of "Camp des Romains" is maintained for another reason; the French public had attached, in recent times, an exaggerated importance to fortifications, *per se;* therefore, it might have proved prejudicial to publish complete details of the German success. On the German side, system demands that no references shall be made to anything in the nature of a reverse and that, even in dealing with successes, care must be taken to suspend references to a success by switching off on to some side track where the end desired has not been fully attained.

An examination into "The Operations on the Somme" is commenced in this part of the *Supplement*. It is pointed out that it was early recognized by the French General Staff that the direct attack on the Aisne front could hardly be brought to a successful issue unless it was accompanied by a flank attack similar to that which was largely responsible for the victory on the Marne. However, the Anglo-French left now no longer rested on an entrenched camp and, since a movement directed with the object of enveloping the enemy's wing was an operation strongly advocated in the principles of war accepted officially in Germany, it was to be expected that the enemy would be on his guard against an attempt of this nature and would seek to meet it by a return to the offensive. These two concordant motives prompted the French General Staff to extend its offensive along the west of the Oise, in order to be prepared against any counter-stroke the enemy might be contemplating. The French telegrams early betray the preoccupations of the French General Staff. The German telegrams, as usual, are less prompt to disclose what is passing in the minds of the Great General Staff and are much less explicit in the statements issued for public information.

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The manœuvre on the Somme marks the end of the Battle of the Aisne. French troops slipped away from their right towards their left, behind a curtain formed by the corps extended along the Aisne front, and prolonged the line of battle towards the north as far as Flanders, and an Anglo-French "*crochet offensive*" faced a German "*crochet défensif.*"

The French version of these operations is next examined.

The first precise mention of an engagement, in force, on the right bank of the Oise is contained in a telegram dated 19th September; in telegrams of subsequent dates, the events taking place in this region are duly chronicled. On the 23rd September, a French telegram announced "Between the Somme and the Oise, our troops have progressed in the direction of Roye. A detachment has occupied Péronne and has maintained itself against fierce attacks of the enemy." On the 26th September, it is admitted that the French troops had to give way before superior forces of the enemy. A second telegram of the same date announces that a very violent battle is still raging between the Somme and the Oise; the Germans have been pushed back, followed by the French who have made progress, extending their front to the north of the Somme. On the 27th and 28th September, a lull in the fighting is reported to have taken place, to be followed on the 29th September by German attacks to the north as well as to the south of the Somme, by night as well as by day. The Germans have been repulsed but the engagement continues to develop northwards. During this period the German telegrams were almost silent on the subject of these operations. A German telegram of the 26th September, *inter alia*, spoke of an "eccentric" attack and the repulse of a French division near Bapaume; the French Press made no reference to this. The affair at Bapaume formed a part of the general operations on the Somme, but the Germans could not refer to this fact, without making the admission that the fighting was becoming further removed from Paris; they had once more to make a choice between announcing what, on the one hand, was of advantage, namely, a partial success, and what, on the other hand, was an inconvenient piece of news to be hidden away, namely, a failure. Therefore, the affair of Bapaume was treated as an isolated episode.

During the early days of October, a change in the character of the struggle is notified, the effort on the Somme front had become more strenuous; that on the Aisne front had slackened. The French communiqués create the impression that an adversary has to be dealt with whose efforts are becoming more strenuous. The orientation of the line of battle is also changing. Telegrams which disclose the progress of events, day by day, between 5th and 12th October, along the Somme front are reprinted in the *Supplement*. They show that from the date last mentioned, the battle has crystallized on the Somme front, as it did 10 days earlier on the Aisne front; it has transformed itself into trench warfare. This part of the *Supplement* contains the opening paragraphs of the German version of the operations, the subject being continued in the fourth part of the *Supplement*.

The German version is colourless as compared to the French. Less use is made of the auxiliary means employed on previous occasions.

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What information is available is all contained in the communiqués of the Great General Staff, and that is little enough. Since it had been announced that the *élan* of the Anglo-French armies had been broken at the Battle of the Aisne, it would never have done to have credited the enemy with renewed activity, involving a new deployment in very considerable strength. This probably explains why the curtain was drawn to obscure the great counter-offensive of the 25th—27th September. It is now known that the greater part of the VI. German Army had been transferred from Lorraine to the right wing, the decisive part of the front, to execute this attack. But the Press was rendered mute on account of its past and could not refer to the operations on the Somme as being in the nature of an attack in force. The communiqué of the 26th September claims that a spirited attack of the Anglo-French forces on the German right wing had been successfully repulsed. Then, except for the affair at Bapaume, the situation did not appear to change sensibly till the 30th September. On the date last mentioned, it was announced that the enemy's troops had appeared to the north and south of Albert. As in the case of the affair at Bapaume, it is stated, that the Allies were in superior force to the Germans; however, they were compelled to retire with heavy loss. Except as regards details, the main facts brought out in the German account correspond with those contained in the French version. On the date last mentioned, it is announced that the heights of Roye and Fresnoy have been captured. A private telegram explains that this occurred during an attempt on the part of the French to envelop the German wing. A communiqué of the 2nd October confirmed that the general character of the operations was as indicated in the above-mentioned private telegram; the French had renewed their attempts at envelopment and Germans had countered this move; on this day it was also announced that some of the Antwerp forts had been taken and Termonde occupied. On the 4th October, it is made known that the battle on the right wing was progressing successfully. On the 6th October, a Berlin telegram announced the extension of the front towards the north with the object of enveloping the French left. Similar information was contained in the communiqués issued on the 7th, 8th and 11th October. The text of telegrams issued from the 3rd to the 12th October are republished *in extenso* in the *Supplement;* these telegrams contain announcements relating to important German and Austrian successes in the western and the eastern theatres of war, and therefore the brief references to the fighting on the Somme, being so to speak in parenthesis, are almost obscured by the more important and impressive news.

The discussion of these operations is concluded in the *Supplement* in a section entitled "The Recapitulation of the Battle." It is considered that it would be useful, before steps are taken to compare the telegrams from the two sources and also certain other information which has come to light subsequently, briefly to enquire into the theoretical considerations involved. The problem to be considered is no longer that of a "*combat de recontre,*" as was the case in August, 1914, when the German and Anglo-French armies came into collision on the Marne, but the attack and defence of a region strengthened by field fortifications.

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The present-day doctrine, as laid down in all the regulations dealing with tactics, is that the occupation of such a position should not be contemplated, except as a last resource. The general theory is briefly sketched out in the *Supplement;* the Battle of the Aisne exemplifies the application of this theory in actual practice. The French higher command, seeing the enemy in retreat before the Anglo-French armies, decided, at first, to launch a direct attack. This attack would disclose whether the enemy was so broken as to be incapable of making further resistance, or whether it was still in a position to make a stand in some chosen position. Hence, the French attacks and the groping along the front during the period, 13th—16th September. Evidence was soon forthcoming that the Anglo-French armies had selected two regions for their principal attacks, that of the Argonne towards the banks of the Meuse, and that to the north of Compiègne, where their left wing was advancing; by degrees, it had become clear that the German army had recovered itself and, since it was deemed to be capable of holding on to the position taken up by it, a flank attack was considered necessary to force the Germans back. Consequently, French reserves were moved to the west; these gained ground, step by step, towards the north, that is laterally; at the same time, the Germans continued to hold these French troops in check and also extended their own line towards the north, on a front parallel to that of their opponents. Then for a day or two, 22nd—24th September, the movement seemed to have come to a halt. The French army on the Marne had put all the men then immediately available into the fighting line; to extend further would have led to a dangerous attenuation of the troops on the front occupied. The Germans now seemed to be on the point of making another vigorous thrust; a counter-offensive was commenced by them along the whole front and continued during 25th—27th September; it was particularly aggressive on the west wing, from Lassigny to Roye and the neighbourhood of Péronne. In the meanwhile, on the French side, troops (partially fresh) were moved into the firing line; they had been formed in rear, to the west of Paris, and consisted of four Territorial divisions and a cavalry corps. Coming from the south of Amiens, this force marched towards the Upper Somme; before it could reach the river, it had to meet the shock of the German counter-attack. In its progress northwards, this French force had become too attenuated and its leading columns gave way before the German onrush. The French commander, however, had no intention of yielding; the French Territorials held their own, fresh reinforcements were hurried up from the Aisne and pushed still further to the north, there to obtain a decisive result. These French reinforcements proceeded, *viâ* Amiens, to the north of the Somme; the cavalry covering the left wing of this force reached the Scarpe Valley. The movements of the Germans during this period is next considered. Hardly had they taken up their position on the Aisne, when their counter-offensive gave some indication of their intentions. At first, their counter-attacks were intended directly to parry the French attacks. Towards the 20th September, operations were undertaken by the Germans in the neighbourhood of Verdun; it appeared as if an attack against the fortress itself was being prepared, any-

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way the French advanced troops in the Woëvre were driven in. At the same time, a German counter-attack was launched against Noyon, on the French left. Lastly, a violent thrust was made in the centre, against Rheims, having for its objective the piercing of the Allied line. These three counter-attacks failed. The Great General Staff, being convinced, however, that it was on the German right front that the serious peril for their army lay, recognized that it was there that every effort should be concentrated, at once, for a counter-stroke. In haste, German army corps were quickly transferred from left to right, from Lorraine to the Somme; at the same time, all detachments in the north of France and Belgium were recalled; it was necessary, at all costs, to upset the barrier which was rising, and becoming longer with each succeeding day, in front of the portion of the German right wing thrown back in a north and south direction. Then, there commenced the great fights, the struggle for the liberation of the Aisne front. German divisions in close columns advanced against the foe; a new counter-attack carried out against Noyon failed; a counter-attack in the region of Roye appeared to succeed one day (the French General Staff admit a set-back), but on the day following it failed also. There it was that the decisive point lay; there the two French armies from the Aisne and the Somme had already succeeded in making a junction. The German armies must bring about their complete separation again, that way lay victory. New German divisions were now brought up, a fresh counter-attack on a grand scale was undertaken along the whole front, first towards Albert, then between the Ancre and the Somme, without cessation near Roye and the region of Chaulnes, to the north of Arras, to the south of Lassigny; this also failed. A final hope remained. There were still German reserves in Belgium. To get rid of the menace of Antwerp, the attack on its southern forts was renewed; the troops not required for this purpose were pushed south. The fronts occupied now extended to the north of Lille, but the principal German effort was still continued in the neighbourhood of Arras and on the Oise. About this time, day by day, the German telegrams begin to be pitched in a lower and lower key: "Situation satisfactory, we commence to gain ground."

According to the point of view from which the situation is looked at, the immobilization of the troops on the front on the Somme may be considered as a check either to one or to the other of the opponents. The enveloping movement against the German right by the French brought about a weakening of the troops available for the defence of the Aisne, but it did not result in the abandonment of this position. The enveloping army was not in sufficient strength to force back the enveloped wing. On the other hand, the effort of the Great General Staff to free the German right wing from the French pressure and to resume the offensive also failed in its purpose. But this is not the question which requires consideration from the point of view of the "*manœuvre morale*," rather is it, which of the two General Staffs can be said to have presented an account of the operations which corresponds most nearly to the actual facts of the situation. In the *Supplement* it is pointed out that an argument of a strategic nature can be invoked in

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favour of the French version; this version draws attention repeatedly to the vigour of the enemy's attacks, whilst the German General Staff is guilty of dissimulation wherever success vanishes from its grip. The latter General Staff was better placed than that of the Western Allies to bring about a transfer of troops from the Aisne front to the Somme. It is unbelievable that it would not have sought to obtain the greatest possible advantage from this situation in order to resume the offensive.

THE BATTLES IN FLANDERS.

The progress of events renders it necessary to commence a new chapter in the history of the war; it is given the general title, "The Battles in Flanders." In dealing with the events chronicled in this chapter a new method of examination is adopted to expose the methods of the "*manœuvre morale.*"

In the case of the fighting on the Marne, the versions of the situation given by the two belligerents have been examined and the characteristics of these two accounts thus ascertained. In the case of the fighting on the Aisne and on the Somme an appeal was made to the accepted doctrines of warfare, specially that of the German Army, in order to establish the standard by which to judge the situation. In the case of the fighting in Flanders, it is proposed to investigate events from the point of view of the elements taken into consideration in preparing an appreciation of the situation and in relation to which, as events have progressed, the daily official communiqués issued by the two parties have probably been framed. By the side of these two accounts is placed a picture of the general impressions formed by an examination of the communiqués covering the whole period; an attempt is then made to draw conclusions from a comparison of the three accounts referred to, which conclusions it is hoped may, at least, have the merit of being based on sound arguments.

In a section entitled "The Preliminaries relating to the Battle of the Yser," attention is drawn to the fact it was first learnt from private sources that a new German army was being formed for operations in Belgium, where it was expected to join up with the German forces released after the capture of Antwerp. The German telegrams had made no allusion to the numbers of the Belgian troops captured in Antwerp. A suspicion arose that the Belgian army had escaped, and later, it transpired that it had got away in time and had reached the sea. The first official news relating to new operations being in contemplation was obtained from a French source; a telegram of the 5th October announced that a large German cavalry force, followed by the other arms, had appeared between Lille and Armentières. The French cavalry was engaged for several days with this force on the banks of the Lys, in the neighbourhood of Armentières and further west, and it appeared that the heads of the German columns had been pushed towards the north-east. Infantry engagements ensued at Lille and this town fell into German hands on the 12th or 13th October. On the latter date, it was announced that the French had assumed the offensive on the front Béthune-Hazebrouck against the Germans reported to be occupying the line Bailleul-Estaires-La Bassée. Further north, engage-

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ments were reported right up to Cassel. At the same time, it was learnt that the Allies had reached Ypres. The only information given by Berlin, at this date, was that Lille had been occupied. A German telegram of the 14th October first refers to the Belgian army, it says: "The enemy's troops, including a part of the Antwerp garrison, are rapidly retreating on Ghent towards the west, in the direction of the coast. Our troops are in pursuit." Next day, the Great General Staff let out the truth concerning Antwerp: "At Antwerp, we have taken from 4,000 to 5,000 prisoners." On the 16th October, a private telegram to the *Journal de Genève* announced that the Belgian army had joined up, on the left of the Anglo-French line, between Armentières and the North Sea.

The situation then, as disclosed on the 16th October, stood as follows: The Anglo-French troops had prolonged the left front of the Allies from La Bassée-Estaires-Bailleul and faced the Germans who had occupied Lille; the extreme left of these Allied troops had advanced to Ypres; still further on the left, the Belgian army had effected a junction with the Allies and had extended the front until it rested on the sea; the German army in pursuit of the Belgians had reached Bruges and Ostend. Private telegrams also indicated that the Germans had been considerably reinforced by formations of the Ersatz-reserve, landwehr and volunteers. It became necessary to exercise caution in preparing an appreciation of the strategic situation. The Allies proclaimed a strategic victory as being already certain; the German newspapers made a similar claim on behalf of the Great General Staff. The succession of events seemed to indicate that the operations were about to enter on a fourth phase. The first had been the "*manœuvre de la Meuse,*" where the Germans had had the initiative and had pushed back their enemy to a distance of some 180 km. (about 112 miles) within the latter's own territory. The second phase had been the "*manœuvre de la Marne*"; the Anglo-French armies had wrested the initiative from their adversary and forced him back over a distance of some 80 km. (about 50 miles). The third phase was that of the "*manœuvre de l'Aisne et de la Somme*"; the Germans wrestled to regain the initiative in the region in which they had been thrust back, the Anglo-French put up a fight to retain it. And now the fourth phase was reached, the "*manœuvre des Flandres*"; the Germans, having despaired of regaining the initiative in the region referred to under the preceding phase, still continued their efforts to gain this end but decided to change the venue for the trial of their prowess; they shifted it 100 km. (about 62 miles) further north, at the same time sheering off towards the west.

Put shortly, the "*manœuvre de la Meuse*" was an offensive on the part of the Germans, a defensive on the part of the Allies; the "*manœuvre de la Marne*" was an offensive on the part of the Allies, a defensive on the part of the Germans; the "*manœuvres de l'Aisne et des Flandres*" consisted, jointly, in an offensive on the part of the Allies, a counter-offensive on the part of the Germans. The Great German Staff took in hand, on a big scale, the strategy attempted on a smaller scale from the days of the commencement of the "*manœuvre de l'Aisne.*"

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In a subsequent section entitled "The Battle of the Yser," the operations which took place between the 16th October and the 5th November are dealt with under three separate subheads. The first of these subheads is entitled the "First Engagements." On the 16th October, the Allies occupied the whole region of the Ypres up to the coast; the Germans had, by this time, invaded Western Belgium, and had penetrated as far as line joining Ostend-Thourout-Roulers-Menin. The communiqués issued from Bordeaux and from Berlin both on the 18th and 19th October are republished *in extenso* in the *Supplement* and disclose the fact that the battle, properly so-called, commenced on the 17th October; at the same time, they provide evidence of a disagreement in the accounts issued from the two camps. On the morning of the 19th October, the German public was not yet aware of the course events had followed during the past 48 hours. So far as they knew Antwerp had been captured and the German hosts were in pursuit of the Belgian army; all else was ignored, it was not worth mention. The French communiqués create a different impression; they show that important events were in progress in the region which had formed the French left and the German right. The problem, which the armies on the Lys had to solve, was whether the French, who had pushed back their opponent some 200 km. (about 124 miles) to the north of the entrenched camp of Paris, would be obliged to retrace their steps or whether the Germans would continue their retirement. For many days the Great General Staff had maintained a strict silence; it would not have done to give any indication that far-reaching changes in the plan of campaign were under consideration. In order, if possible, to deceive the enemy as to their real intentions violent and repeated attacks were made by the Germans on the front Lassigny-Roye-Albert, so that the Allies might be induced to fix attention on this region and retain their forces in strength there. However, the latter discovered the surprise packet in preparation for them in good time. Since the 6th October, the communiqués of the Allies had reported the presence, in the north, of large masses of German cavalry and also indications of a German offensive move being in preparation. At this same period, the Germans, who had been content to observe Antwerp during the whole of September, suddenly decided to rid themselves of the menace which the retention of this fortress in the enemy's hands created. Active steps were taken on the 28th September to reduce Antwerp. The Allies, having come to the conclusion that, in spite of the desultory attacks continued by the Germans, the Battle of the Aisne had been won, took steps on the 6th October to prepare a counter-manœuvre to meet the latest developments of German strategy; as on previous occasions they made preparations for acting on the offensive. Whilst the Belgian army from Antwerp was marching on to the Yser, the Allies had massed the bulk of their forces in the region Hazebrouck-Béthune, in order to effect an offensive move astride of the Lys. In case of a success here this would have proved more advantageous than a direct counter-stroke against the German offensive movement along the coast; an Anglo-French success would have placed the German forces between a victorious enemy and the sea. On the other hand, if the German right wing had won the

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day, any check that the Allies might have suffered would not have imperilled their line of retreat and, therefore, would not have been of a serious nature; the Allied front would merely have been drawn back. The examination of the foregoing facts shows what value is to be attached to the German telegrams; nothing seemed, at this time, to possess any importance whatsoever in the German mind.

The second subhead deals with "The Decisive Phase." The communiqués issued from Bordeaux and from Berlin, on each day, from the 20th—27th October are republished *in extenso* in the *Supplement*. During the period covered by these communiqués, the general situation does not show, what may be called, a change; however, all this time, the Germans were making desperate efforts to break the Allied front on the line Lille-Ypres-Dixmude-Nieuport. The Berlin telegrams of this period create the impression that the decision was going steadily and continuously in favour of the German troops, in spite of the support which the British fleet attempted to afford to the left flank of the Allied line. From the Berlin message of the 26th October, it would appear that practically the whole of the canal had passed into the possession of the German troops, the Allies being left with only its extremities in their hands. Success smiled on the Germans also along the remainder of the front, in the region of Lille from the commencement, and at a later period in the region of Ypres. The French telegrams tell of events of a much more fluctuating character and are more in keeping with, what is known to form, the main features of a battle raging on so wide a front as that actually occupied. Berlin, on the 24th and 25th October, claimed that the passage of the canal had been forced on the left, *i.e.*, at a point held by the Belgians; the earlier French telegrams make no mention of this, but at 7 a.m. on the morning of the 26th October, the French admit that the Germans had crossed the Yser, between Nieuport and Dixmude, and in a later telegram, of the same date, issued at 3.35 p.m., it is announced that the Germans who had crossed the Yser had made no further progress. It will be remembered that attention was drawn to the adoption of a similar course by the French in dealing with the episode of St. Mihiel. Whilst the Belgians held the canal from Dixmude to the sea, fluctuating movements were taking place on other sectors of the front. During the early days of the battle, loss of ground near Bassée, south-west of Lille, was announced, and also that ground had been gained near Armentières; then followed progress in the regions of Langenmark, Armentières and Lille. A comparison of the communiqués during the decisive phase of the battle indicate that, if any advantage at all was gained by the Germans, this took place on the extremity of their line in the west; the effect of such a strategic success would be alone to push the Allied left flank back along its natural line of retreat. This portion of the Allied line may be supposed to have been pivoted on Arras; the displacement of this pivot would have only resulted in tactical victories. The topography of this region contributed largely towards rendering tactical progress laborious. The Yser Canal is only the first of the obstacles to an advance in this region. The German right wing would also have to traverse the Moeres district which had already become famous in the history of past wars. In a relatively short time all the

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region north-east of Dunkirk, from Moeres to Bergues and to Furnes, could be inundated. In spite of the confident tone exhibited in the German telegrams up to the 26th October (that of the subsequent date is silent on the subject of the canal), the German attack had only obtained indifferent results; their telegrams admit as much. The telegram of the 24th October referring to the passage of the canal spoke of an *important* force having crossed this obstacle; the telegram of the following day had increased its dimensions to a *new force in considerable strength.* Under the circumstances, the success of the whole operations may, at least, be supposed to have been doubtful. A third subhead entitled "The End of the Battle on the Yser," is commenced in this part and concluded in the fifth part of the *Supplement.* The situation is introduced by a republication, in the *Supplement,* of the communiqués issued from Bordeaux and Berlin, day by day, from 28th October to 5th November (those up to the 31st October appear in the fourth part). The German offensive on the Yser seems to have reached its maximum violence from the 24th to 27th October; on the 28th October, there was a weakening in their effort. The French telegram of the 29th October refers to the German attack having moderated, whilst the German telegram of the same date announces the arrival of Belgian reinforcements. However, the Germans had not admitted their check, they still claimed to be gaining ground, even on the 30th October, although the French had already made known that inundations extended along the banks of the Yser. The Germans, it appeared, had even attempted to resume the offensive right up to the inundated zone; but this was the end. On the 1st November, they admitted the difficulties caused by the inundations and, two days later, that it was impossible to overcome these difficulties.

The Germans retired from this region without experiencing any loss whatever, at least so they said. This retreat, however, it was claimed, had brought immediate compensation elsewhere. The announcement of the capture of a series of localities between Dixmude and Lys would, no doubt, provide consolation to the German public for the abandonment of the canal after its successful passage. A German attack on the front Ypres-Lille aroused great expectations. A success on their left wing (on this front) would cause the flank of the Allies on the Somme to be uncovered; on the right success would bring the Germans in rear of the Yser defences. The terrain seemed also to be less difficult; by advancing on the Ypres-Lille front, the zone which can be easily flooded was avoided. The German public therefore need not trouble itself concerning the check on the Yser since, after all, it only resulted in a local retirement and did not involve a defeat at the enemy's hands; the operations were only of secondary importance. As a matter of fact, the communiqués relating to this phase are not in agreement; even the Belgian telegrams which had, in their contents hitherto, followed closely the information given in the French and English telegrams, now contained matter of a contradictory nature. However, these telegrams enable the front held to be traced approximately. It is enough to seek the regions in which the belligerents claim successes.

On the 30th October the Germans had taken Bixschoote, and they

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claimed, on the same date, to have occupied Zandvoorde and Hollebecke, to the south of Ypres, and on the 2nd November to have captured Messines. The Allies had announced that they had progressed north-east of Ypres, in the neighbourhood of Passchendaele which stood at the salient of the angle formed by running a line through Bixschoote-Passchendaele-Messines. Little importance need be attached to the differences in details. For example, the Allies had given out that they had retaken Messines partially and Hollebecke entirely, thereupon the Germans, who had at first claimed to have seized the latter village, of their own accord explained that their claim was confined to the occupation of the Château only. These incidents have no material bearing on the broad aspect of the operations, which bear evidence of a convergent attack by the Germans on Ypres, and the very large forces employed for this purpose afford proof that an enterprise, from which decisive results were expected, had been undertaken by the Germans. In theory, such a situation should have turned out unfavourable to the Allies, but a scrutiny of the telegrams discloses no remarkable difference in the tactical situation of the two sides. The later despatches, indeed, seem to betray either a suspension or a relaxation in the German effort. To the French claims of the 4th and 5th November, relating to sensible progress having been made by them between Dixmude and the Lys, the German telegrams make a reply, in a decreasingly minor note, which almost amounts to an acquiescence. The most that can be said is that, after many days of strenuous fighting, the German Army had not obtained any permanent success on the Lys. There was even a momentary suspension of the German operations, which coincided with the definite check met with on the coast. The consequence of this was that the Allies, finding it no longer necessary to preoccupy their minds with the Yser sector, were in a position to transfer their available forces into the Ypres region; they did so with all the advantages to be obtained from the increase of *morale*, arising from a success, whilst the enemy had to suffer all the disadvantages experienced after a reverse, especially where very considerable forces are engaged and the loss suffered is heavy. The persistence of the French attack on the front Dixmude-Passchendaele largely neutralized the value of the German attack on the front Passchendaele-Messines. Theoretically, the latter, being a flank attack, constituted a grave peril to the Allies. The check to the German arms on the Yser Canal, it is held, prognosticated a general weakening of the German offensive in Flanders.

The next section of the fifth part of the *Supplement* deals with "The Battle of Ypres"; it opens with a reprint of the communiqués issued from Bordeaux and from Berlin, each day, from 6th—8th November. The French telegram of the 6th November indicates that the battle, between Dixmude and the Lys, which was dying away had suddenly broken out afresh. A similar outbreak of activity on the part of the Germans occurred, at the same time, on the Aisne and on the Somme. This German manœuvre was intended to cover the retreat of active troops in the north. It also confirmed the information, coming from private sources, which had reported the arrival on the Yser of newly-

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formed, or second reserve, army corps from Germany. These troops had been tried severely on the Yser and, for the attack on Ypres, it became necessary to double the active corps; consequently troops of the former reserve were drawn from other parts of the front. On the side of the Allies reinforcements had come up, a continual transfer had been taking place from the Aisne and the Somme to the Flanders front. The German telegrams announced appreciable progress, on the 6th November, but this was done probably with the object of discrediting the suggestion that the enemy might be about to resume the offensive again. Soon, a delay in the movements was announced and attributed to the mists which then prevailed. The communiqués issued from the two headquarters, on the 9th and 10th November, are reproduced and their contents examined. They show that, during the 8th and 9th November, the action had recommenced once more, and again it is on the front between Dixmude and the Lys that an attempt is made to obtain a decisive result. On the 9th November, the Germans returned to the charge and the opposing lines on the offensive came into collision. The telegrams referred to state the claims of the two parties; these telegrams contradict one another flatly. Each side claimed to have defeated the other. Finally, the communiqués issued from Bordeaux and from Berlin, day by day, from 11th—15th November bring the account of the Battle of Ypres to an end, although both sides continue to announce desultory fighting on dates subsequent to that last mentioned. After the partial suspension of activity on the 8th November the Germans had recommenced operations with a violent intensive effort; their hopes ran high that this effort would be crowned with success, that is to say, if the tone of their communiqués was not intended to deceive. A change is also noticeable in the tone of the dispatches of the Great General Staff announcing the capture of Dixmude. A French communiqué, issued on the 11th November, admitted that the Germans were in possession of this place. The Great General Staff, on the same date, not only announced the capture of Dixmude, but also that "*our troops* have crossed the canal." It is pointed out that the use of the words "*our troops*" was capable of creating an impression that an offensive movement on a big scale had been carried out, and yet the words might equally refer to the passage of a patrol merely, or even of a company. The expression used is elastic and prudence dictated that there should be a suspension of judgment on the situation described. On the following day it is seen that the success, of the 10th November, has not come up to expectations. Berlin still announces that the attack along the canal south of Dixmude has made progress, but the information is tainted with the same uncertainty as that created by the first announcement. During the whole of the 12th November, the possession of this canal crossing had not permitted the main attack of the Germans to obtain the decisive results which were to change the face of things in Flanders. The incident terminated similarly to that at St. Mihiel. The German offensive in Flanders wasted away, as did those which preceded it on the Aisne, at Noyon, on the Somme, to the north of Arras, as well as to the south of Lassigny. The Bordeaux telegrams, on the other hand, tell of the successive reoccupation of ground lost and a weakening of the enemy's attacks, whilst they mention the

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persistence of the "*mouvements d'approche*" of the general fighting line of the French; the German communiqués refer only to the difficulties of the undertaking, quibble about the value of the partial success of their opponents and make much of incidents occurring in places far removed from the decisive theatre on the western front. Assuredly the Kaiser had lost the battle.

The operations in Flanders are summed up in a section entitled "The General Character of the Battles in Flanders." It is pointed out that the earlier engagements were of the type known as the "*bataille de rencontre.*" Neither one side nor the other was willing to abandon the initiative, both still desired to wage war in accordance with the doctrines inculcated by the advocates of the offensive. However, circumstances were about to impose a different attitude on them. The immediate means for carrying on the offensive failed the Allies; the convex form of their front rendered the transfer of troops from east to west a tedious and long operation; the reinforcements for the British troops could alone be provided on a small scale. In the case of the Allies the spirit of the offensive remained intact, but its application had to be postponed. In the case of the Germans, the necessity which existed for fighting simultaneously on two widely separated fronts did not permit of any postponement. A new German army was organized in haste, soldiers trained for only six weeks, volunteers and others, young and old, were quickly gathered together. This army was pushed immediately into the firing line on the extreme right wing on the western front, whilst the transfer of troops from east to west in the north of France and in Belgium was taking place in connection with the consolidation of the German front from Lille to the sea. At this moment, the general plan of the great battle of the west became clearly defined, the front of the Aisne and even that of the Somme were nothing more than "*fronts d'opérations suspensives.*" That from Lille to the sea along the Lys was the front of an immense échelon jutting out from Germany, having a "*refused*" wing which precipitated itself with violence on the enemy and made offensive counter-strokes on a large scale after it had checked the enveloping attack of the enemy. Taken as a whole, this immense manœuvre of counter strokes, over a front of more than 100 km. (about 62 miles), lasted four weeks and consisted of three distinct phases:—

(*a*). The operations round Lille, which connect, in time, the attempts to liberate the Somme front with the counter-attack of the wing, properly so called.

(*b*). The operations of the Yser, carried out by the German army from Antwerp and the new reserves.

(*c*). The operations in front of Ypres, representing the supreme efforts of the remains of the army referred to in (*b*) absorbed into the reinforcements brought from other fronts.

If these three phases are considered as a whole, whereof the third admits of two representations, it is seen that the battle resulted in a sharp and bloody struggle which lasted for 30 days. From the first day to the thirtieth it had gradually developed from the sea towards Lille, passing by the Yser Canal, to the north, to the east, to the south-

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east of Ypres and by the west of Lille. And when the battle was finished, it was still on this self-same line that the last of the German communiqués speak of the same good progress made, of the same success won, slow maybe but sure, the same satisfactory advance. Nothing had changed, there was only one German army the less.

The fifth part of the *Supplement* concludes with the consideration of the "manœuvre morale des Flandres"; the tactical operations are first dealt with. If the succession of French and German communiqués are examined closely and compared, on the whole, no marked contradiction in their purport will be observed. As on previous occasions, it will be found, the German Press had been more careful than the French, not only to carry dissimulation to excess, but also to suppress reference to all reverses. The French picture represents a defensive battle, the German picture an offensive one. The difference only appears clearly from the conclusions to be drawn. The French defensive brings about a check of the enemy's attack; the operations end, because the attack has failed. On the other hand, it is claimed that the German offensive is victorious, the German troops continue to progress, although as a fact, they have lost the battle. The foregoing summaries show that the news services have remained faithful to the regulations drawn up for their guidance, that is so fundamentally; however, an evident evolution is taking place in the form of the German service. By degrees, it succeeds in imitating that of its adversary. Greater exactitude is also shown in the terminology adopted; the tone is circumspect. In a general way, the attempt to play on the imagination of the public is abandoned in the official service of the civil authorities, as also in the auxiliary information service of the Great General Staff. Such was the situation during the period of the operations of the Aisne and of the Somme. The Battle of Flanders marks a new evolution in the system. The auxiliary official information service disappears in its turn, and only the communiqués of the higher command and the so-called private Press telegrams remain. The private Press telegrams are only private to the extent that they are issued anonymously. A certain number of the so-called private telegrams are reprinted in the *Supplement* and a comparison of their contents with those of the official communiqués shows how closely the two sets extend and support one another in the interests of the "*manœuvre morale.*" The consideration of the aspect of the question dealing with the strategical operations is commenced in this number.

W. A. J. O'MEARA.

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REVIEW.

HISTORY OF THE CORPS OF ROYAL ENGINEERS, VOL. III.

By COLONEL SIR CHARLES M. WATSON, K.C.M.G., C.B., M.A., late R.E.

THE following is compiled from the *Morning Post* of July 19th:—

Colonel Sir Charles Watson's third volume, covering the years 1886—1912, exhibits the same characteristic of ubiquity as the previous two volumes (Major-General Whitworth Porter's *History of the Corps*, Vols. I. and II.).

The organization of the Corps is a subject of professional rather than of general interest. Sir Charles Watson shows separately the War Office Staff and the District Organization. The story of the regimental units of the Corps is continued from the previous volumes: many new and increased duties have, with the advance of science, devolved upon them, such as Submarine Mining (transferred to the Royal Navy in 1905), the working of electrical searchlights, military balloons and telegraphs. Large additions to the Corps were authorized for the South African War, in which 250 officers and 5,220 men of other ranks took part. The details are all available, but cannot be given here. The Aeronautic Corps was again reorganized in 1911. The construction and maintenance of barracks for the accommodation of the British Army at home and abroad has previously been one of the important duties of the Royal Engineers, which has now, for the first time, its history completely narrated. In 1793 the barracks were removed from the charge of the Board of Ordnance, and a new Barrack Department was created. Under an extraordinary system extravagant expenditure of the Barrackmaster-General was for a time practically unchecked until the post was abolished. Barracks were again under the Board of Ordnance for thirty years before 1855. There is now a Civil Department called the Barrack Construction Department. The services rendered by the Engineers in the Sudan campaigns of 1885—1899, and in the South African War, are chronicled at sufficient length. The Survey work performed by the Corps has been very widely extended in all branches and in many countries, whether in cadastral work, the delimitation of boundaries, exploration, or the revision of maps.

The short biographies of thirty distinguished officers of the Royal Engineers carry on the series which was commenced in General Porter's volumes. If other evidence were wanting, they afford proof of the variety of careers open to members of this Scientific Corps. They should show to young officers what their predecessors have achieved, and the rewards attainable by success in able and devoted service. The whole volume is, indeed, replete with information and instruction.

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SUGGESTIONS FOR CARRYING OUT FIELD COMPANY SCHEMES.

1. *Preparing a "Locality" for Defence.*—This includes :—

(*a*). Reconnaissance of locality.

(*b*). Placing look-outs.

(*c*). Bringing up first-line transport under cover to nearest point to scene of work.

(*d*). Marking trenches on ground, including dug-outs, communication trenches, etc.

(*e*). If locality has to be prepared entirely by R.E., placing the men at their tasks with proper tools.

(*f*). If infantry working parties are sent, allotting sappers to the more technical tasks, arranging N.C.O.'s or sappers to show the infantry what to do, etc.

(*g*). Making a plan on such a scale (at least 40 in. to 1 mile : 1 in.=50 yards being convenient) that an infantry subaltern would be able to carry out the preparation of the defence if the R.E. are called away.

(*h*). Should the locality consist of buildings, the loopholing of walls, barricading of windows, and destruction of outbuildings and trees, etc., interfering with field of fire, must be included in the work and shown on plan and sections.

(*i*). Bold freehand sections should be plentiful—not cramped, indecipherable drawings. N.C.O.'s should be taught to make these.

(*j*). The scheme will comprise in all cases a rough but clear table showing how all the men in the Field Company Section are utilized, and the responsibility allotted to the N.C.O.'s.

2. *Obstacles and Clearings.*—When the scheme includes the above, follow out generally the instructions in paras. (*a*) to (*c*), (*e*) to (*f*), (*i*) and (*j*).

3. *Pontoon Bridging.*—When this is ordered, carry it out actually.

4. *Trestle and Other Bridging.*—When this is ordered, all that is required is a section and a statement showing where materials are available, and the working parties and transport can be found. Do not forget that local wagons, with the horses from the tool carts, will often be found convenient for transport, local horses also if obtainable.

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5. *Diary of Work.*—A diary of the day's scheme, including times, will invariably be kept. The record of *times* is most important. Use the *Field Pocket Book* (AB 153) for diaries.

6. *Communication with C.O.*—This is of all importance. Acknowledge all messages. The C.O. will always tell you where to find him. On reaching the scene of work, send a cyclist to the C.O. This cyclist will be kept by the C.O., and, knowing the way back to his section, forms a most valuable link between the various parts of the company.

7. *Roads, etc.*—When the scheme includes the construction of roads, mark out the road on ground, state where materials are available and what means are at hand for transporting them, and how you allot your N.C.O.'s and sappers to superintend working parties of infantry. Plans and sections showing how the road is made must be provided. These instructions also apply to the improvement of existing communications, *e.g.*, the improvement of a country lane or farm track into a motor road, etc. Do not forget the value of bricks, planks, etc., from buildings, the use of hurdles, brushwood, tree trunks, etc., for improving roads on soft ground.

8. *Approaches.*—Do not forget that every bridge needs an approach.

9. *Trenches, etc.*—When not ordered to be actually made, must be traced, and working-party tables drawn up. Plans and sections on suitable scales.

10. *Topographical Sketches.*—When a sketch is required, enlarge the ½-in. map to 4 in. = 1 mile and put in all detail useful for military purposes. Insert approximate contours, figured.

11. Hand in full reports at conclusion of operations.

12. Carry out all schemes under active service conditions.

13. *Bivouacs and Water Supply.*—When equipment is available, actually carry out the water supply. When not available, draw clear plans and sections, and show details on a table with distinguishing letters.

14. Do not forget that these schemes are for your own instruction and that of your N.C.O.'s and men. It is only by constant explanation to them that you will get the fullest value out of the training. It is of the greatest value to all ranks that they should find out in peace training as many as possible of the small practical difficulties that will occur in war.

F. G. GUGGISBERG.

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ELECTRIC REMOTE INDICATORS FOR RIFLE RANGES.

(*Reproduced with the kind permission of the Editors of "The Electrical Review"*).

ATTEMPTS have occasionally been made to employ electrical apparatus in rifle ranges for signalling the value of each shot, but the arrangements so far devised have usually been of a rather rudimentary description, and could be used only in conjunction with the usual mechanical indicators.

The Marksmen's Society, of Spandau, near Berlin, just before the outbreak of war, took a decisive step in this direction by having

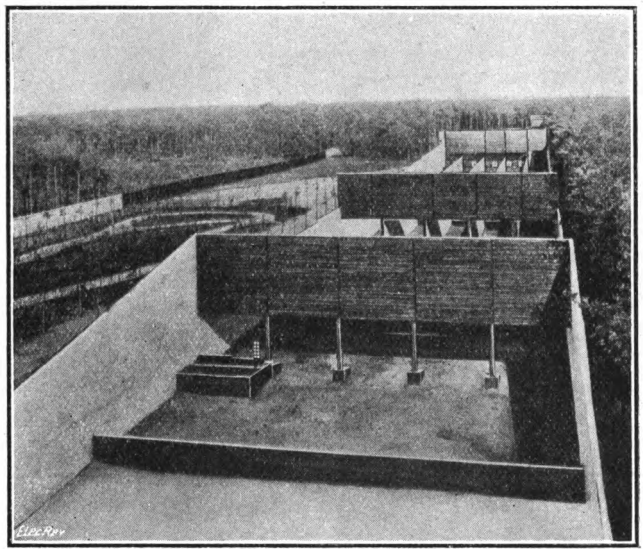

FIG. 1.—*Rifle Ranges at Spandau.*

all its rifle ranges fitted with electric remote indicators on the Siemens system. The installation, which was supplied by the Siemens Co., offers a number of novel features, and may be briefly described.

The Society owns extensive shooting grounds, comprising three 300-m., 12 175-m., and two 100-m. ranges, and one of 35 m. Each range is fitted with a transmitter and a receiver, serving to signal the number of the rings hit each time. Each of these apparatus, connected together by electric cables, possesses a scale, the 23 divisions of which bear the inscriptions 0, 1, 2, 3, . . . 20,

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"telephone" and "stop." The transmitter is installed to the left of the target, between the guide bars of two contiguous targets (*Fig.* 2), there being no need to provide any special room for it, as in connection with previous installations. The receiver is arranged at the firing point, to the left of the marksman (*Fig.* 3), and is readily read and checked by the latter, as well as by the secretary seated immediately behind him. Each transmitter and receiver comprises an index fitted with a handle, which is easily adjusted by hand, the pointer and handle of the transmitter being connected, in the interior of the casing, with an adjusting arrangement resembling a small

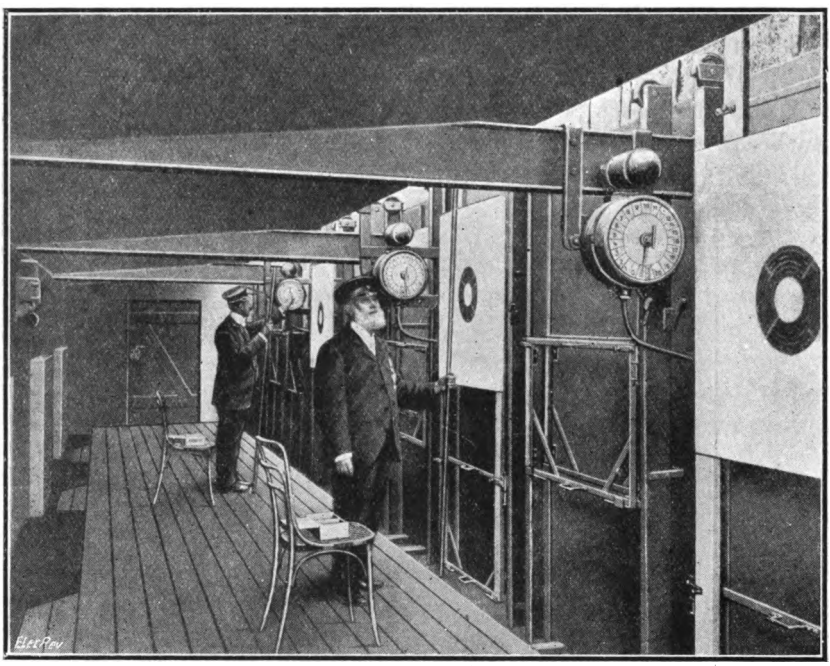

FIG. 2.—*Transmitters at the Butts.*

electric motor (*Fig.* 4), which ensures perfect agreement in the readings of the two apparatus. The index of the receiver is shifted by a similar system, and, being protected by a glass plate, cannot be interfered with by the marksman.

With each new reading marksmen are advised by a short acoustic signal given by an electric buzzer, at the transmitter and receiver, which is readily distinguished from the bell signals employed for other purposes. At the marksman's post and on the desk of the secretary seated behind him, there are push buttons actuating simultaneously the buzzers of the transmitter and receiver, which are distinguished by their different timbre.

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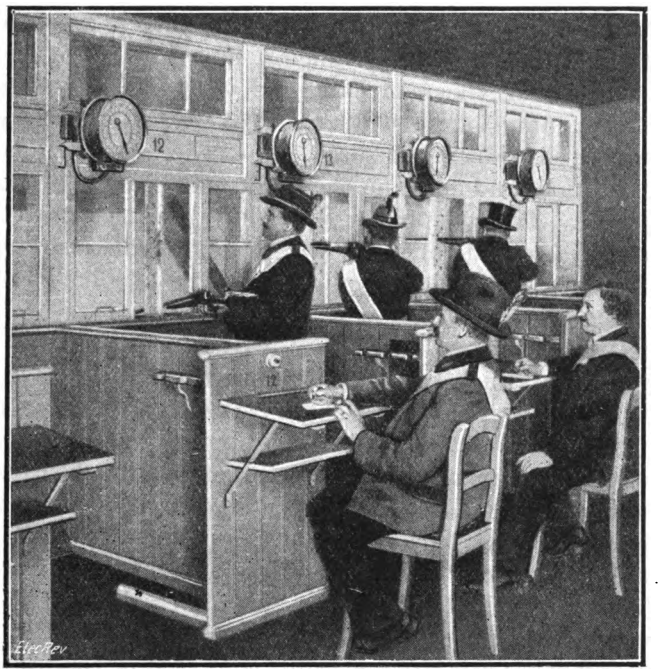

FIG. 3.—*Firing Point, showing Receivers.*

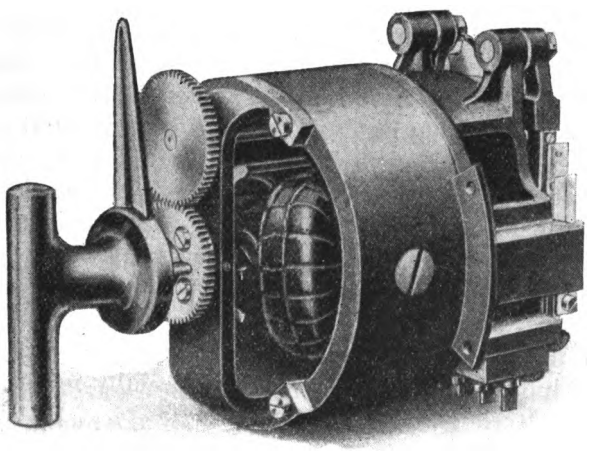

FIG. 4.—*Mechanism of Transmitter.*

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The installation further comprises a telephone plant. Water-tight telephones, arranged in the passage-way of each range, are connected up to an indicator switchboard installed in a special cabin, whence each telephone is readily called. In order to get a connection with his marksman, the man entrusted with the operation of the transmitter has only to adjust the index of the latter to the division "telephone," thus causing the receiver index to take up immediately the same position, and advising the marksman that he is wanted on the telephone. The telephone plant has been designed on the central-battery system, the battery being installed so as to be protected against atmospheric influences. The telephone apparatus are joined together by means of armoured cables.

The installation works as follows:—After taking up his post at the firing point and firing his shot, the marksman presses down the push button on his left, thus actuating the buzzers of his receiver and transmitter and calling the attention of the operator. The latter looks for the mark left on the target by the shot just fired, pointing out with a small rod the section in which this mark is found (top, bottom, right or left). Having then taken down the target, he adjusts the transmitter index to the number of the ring hit by the marksman. While he is shifting this index, the electric buzzers of the transmitter and receiver are sounded simultaneously, and the receiver index takes up the same position as that of the transmitter. The operator finally pastes some paper on the mark made by the bullet, after which the target is ready for another shot.

The first cost of this electrical outfit is in most cases more than made up for by the saving of ground and accommodation. Operating expenses are extremely low. At Spandau, three-phase current at 220 volts, 50 cycles, is available for feeding the apparatus, thus allowing a very simple type of alternating-current indicator to be used. The 18 shooting ranges are arranged in six groups each of three, and as each group has an armoured underground cable of its own, any breakdown in operation will be limited to the three ranges of a given cable. Each group communicates with the electric mains through a transformer stepping down the pressure from 220 to 55 volts. The consumption of power of each transmitter-receiver set is about 28 watts.

An additional advantage of the electrical indicator is the possibility, as brought out by actual experience, of shooting at a rate 50 per cent. higher than usual, which is especially important on the short winter afternoons.

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THE PRACTICAL PROBLEM OF TELEGRAPH TRANSMISSION FROM A NEW ANGLE OF VIEW.

By MAJOR W. A. J. O'MEARA, C.M.G., *p.s.c.*

THE theoretical aspects of the problems connected with the transmission of electric currents for telegraph purposes have been closely studied by eminent mathematicians and physicists from the earliest days of the development of electric means of communication; one of the first of the important contributions to the science of telegraphy was the paper by Lord Kelvin (then Professor Wm. Thomson) "On the Theory of the Electric Telegraph," published in the *Proceedings of the Royal Society of London* in 1855, and much information of practical value in relation to this subject has been published since that date.

The telegraph engineer of pioneer days, as does his successor of modern times, utilized for the transmission of telegraph signals a source of energy the use of which was intended to cause a current of the maximum amplitude required in a given circuit to flow from the moment that the transmitting device was operated; that is to say, an effort was made to send out square-topped electric wave impulses, and this was the case both for the purposes of ordinary land as well as long-distance cable telegraphy. There was, and still remains, this difference between the systems of signalling in the two cases, namely—whereas in the case of the former the elements of a letter were, and are still, formed by current impulses of the same sign but of unequal durations of time, on the other hand in the latter case these elements were, and are still, formed by current impulses of opposite sign but of equal durations of time; the two systems of signals are shown side by side in *Plate* I. In Lord Kelvin's paper, to which reference has been made, mathematical data were provided which enabled the telegraph engineer to calculate, for the different conditions of electric circuits, the ordinates of the "curves of arrival" of the current impulses used in telegraph signalling. Since the form of the "curve of arrival" practically determines the number of decipherable signals which can be sent in unit time along the conductor forming a telegraph circuit, the subject was of immense importance in connection with the design of long submarine cables. The "curve of arrival" is obtained by plotting, as ordinates, the

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various amplitudes of the received currents to some scale calculated in relation to the intervals of time reckoned from the instant of applying the battery at the sending end, these intervals of time being plotted as abscissæ; "curves of arrival" enable an engineer to visualize what is taking place, instant by instant, at the receiving end of telegraph circuits, and the characteristics of conductors can thus be studied in relation to their electrical constants. Since the early days of the electric telegraph other means have been discovered for ascertaining the nature of the "curve of arrival"; of these means the oscillograph is perhaps the most useful for practical purposes. The use of an oscillograph permits a photographic record of the current fluctuations, at any accessible point of a circuit, to be made instantaneously, and the necessity of making tiresome mathematical calculations to determine what may be taking place in a conductor, from point to point, is thus entirely obviated. The ordinates of a "curve of arrival," based on the data contained in Lord Kelvin's paper, have been calculated and the curve has been plotted (*vide Plate* I.); its form shows that the current takes quite an appreciable time, after the battery is applied, to rise to its maximum amplitude, and that, indeed, for a short interval after the current is started, known as the "silent interval," no measurable current reaches the receiving end of the circuit. Telegraph engineers have made considerable use of the scientific data placed at their disposal; they have, however, concentrated their attention on the improvement of line conditions and the designing of extremely sensitive apparatus for operating the devices installed at the receiving end of a line, but have, to a great extent, neglected the study of the source of energy question.

Without a doubt, marvellous progress has been made during the past 70 years or so; improved types of transmitting and receiving apparatus have been designed; a machine has been constructed for automatically recording received messages at high speed (100 to 120 words a minute) type written in page form; another machine has been constructed in which the spark from the discharge of a condenser is employed to photograph on to a moving band of sensitized paper, which is automatically fed into a fixing bath, the images of letters and other symbols cut in stencils fixed to the periphery of a rapidly revolving plate: this band of photographic paper is delivered ready for use almost immediately after the completion of the message. But in all these cases the source of energy, almost universally employed for transmitting the signalling wave impulses, is the constant potential type used from the earliest times: the only changes which have been made in this part of the telegraph circuit, consist in the substitution of secondary cells for the primary batteries, the utilization of direct current lighting installa-

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tions in connection with telegraph signalling, and the use of specially designed dynamos (confined almost entirely to the United States of America), that is to say, the square-topped wave impulse has been retained in use for telegraph purposes in spite of its patent defects. The curve representing the square-topped telegraph signalling wave impulse is, after all, merely a type of complex periodic curve, and, as is well known, Fourier showed that any periodic curve, as long as it nowhere goes to an infinite distance from the axis of X, can be built up by compounding together a finite number of harmonic curves, the periods of which are commensurate. Nowadays, the analysis of a complex periodic curve for the purpose of determining the amplitudes and phase angles of the different harmonics of which it is compounded can be effected either mechanically by means of machines specially constructed for the purpose, or mathematically.

The mathematics of the theory of electric wave transmission discloses the fact that, in the case of the propagation of electric waves along certain classes of conductors, the waves of different frequency or wave length travel at different speeds and attenuate at different rates, that is to say, in such cases a complex periodic wave impulse undergoes *distortion* during transmission. The above theory shows that in the case of the transmission of telegraph signals along aerial conductors of low electrostatic capacity β, the attenuation factor is independent of n, the periodicity of the signalling wave impulses, but that in the case of transmission along conductors in cables, whether subterranean or submarine, this is no longer so. In the latter case β is theoretically proportional to $\sqrt{n}$, although tests show that this relation is not always obtained with strict accuracy in practice. The amplitude of an electric current along any conductor, as is well known, decreases during propagation in the ratio of $1 : \epsilon^{-\beta l}$, where β is the attenuation constant per unit length of conductor (per mile or per km.), and l is the distance, in the same unit of measurement, from the end at which the potential is applied and ϵ is the base to the Naperian system of logarithms. How very great is the difference in the rate of attenuation of the different harmonics of a complex periodic wave impulse may be seen from the figures relating to a particular copper conductor in a cable, certain data regarding which are available for the purpose of making the necessary calculations. The constants of this conductor are as follows :—

Diameter	=2·55 mm.
Electrostatic capacity	= ·07 mfd. per km.
Inductance	= ·0004 henry per km.
Resistance	=3·322 ohms per km.

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The measured values of β for this conductor, at certain periodicities, were ascertained to be as follows :—

$n=400$ ($\sqrt{n}=20\times 1$).	$n=1000$ ($\sqrt{n}=20\times 1\cdot 581$).	$n=2000$ ($\sqrt{n}=20\times 2\cdot 236$).
·023	·033	·041

Utilizing the above values of β, the amplitudes of the received current of an initial amplitude of 100 milliampères have been calculated, for the frequencies stated above, in respect of certain lengths of the above conductor, the results obtained are as follows :—

Length of Circuit.	Distance between Towns Named = Length of Circuit.	$n=400$.	$n=1000$.	$n=2000$.
10 km.....	--	79·453 ma.	71·892 ma.	66·365 ma.
100 km.....	London—Portsmouth ...	10·026 ma.	3·688 ma.	1·657 ma.
150 km.....	London—Birmingham ...	3·1745 ma.	·7083 ma.	·2133 ma.
300 km.....	London—Plymouth	·10077 ma.	·00502 ma.	·00045 ma.
700 km.....	London—Perth	·000010185 ma.	·000000009 ma.	·00000000003 ma.

The above values demonstrate that a wave impulse of a given amplitude transmitted at the lowest of the frequencies for which calculations have been made, even in the comparatively short distance of 300 km. from its origin, decreases in amplitude to nearly the one-thousandth part of its initial value, whilst the same current transmitted at the highest of the frequencies given above at the same distance of 300 km. decreases to approximately the 200-thousandth part of its initial value, that is to say, in this particular case the fifth harmonic decays 200 times as fast as its fundamental sine wave in the short range of 300 km. The other values given in the table speak for themselves.

The fact that current impulses of different frequencies are propagated at different velocities along any given circuit results in the displacement of the phase angles of the various harmonics composing a complex periodic wave impulse in relation to its origin or starting point, and hence relatively to one another ; for instance, in the case of the 2·55-mm. conductor, already referred to, under certain conditions of dielectric conduction (leakance) the lag is only 2 degrees per km. in the case of the sine wave having the frequency $n=400$, whereas in the case of the harmonic having the frequency $n=2{,}000$, the lag increases to 4·5 degrees per km. This phenomenon of different phase-angle displacements which occurs in the case of the several component waves of a complex wave impulse is analogous to the phenomenon of refraction when white light passes obliquely from a medium of one density into that of a different density ; and the displacements of the phase angles of sine waves of the different periodicities can, in relation to any known distance from the transmitting end of a conductor, be represented diagram-

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matically to scale in a manner similar to that employed to depict the refracted positions of light waves of different frequencies in a diagram of the solar spectrum. For instance, if a line YZ be graduated in electrical degrees, there can be marked along it the displacements of the phase angles of the sine waves of the various frequencies arising in connection with the transmission along any particular conductor of a complex periodic wave impulse compounded of the sine waves in question. If normals to YZ be drawn in appropriate colours (shading into one another) to mark the positions of the displacement of the phase angles of each of the sine waves present in any complex periodic impulse a coloured spectrum scale is obtained; so that if such spectrum scales be suitably drawn in respect of electrical circuits of the same length, but of which the electrical constants differ, means are obtained for a rapid visual comparison of what may be termed the dispersion properties of the conductors under investigation. The general idea of the spectrum scale method of representing the transmission properties of a conductor is shown in skeleton diagram in *Plate* II., in which the comparison of two conductors, of which the constants are given, can be made at sight. This diagram can also be utilized for reading off the lag of the phase angle at any intermediate point of the conductor, thus: erect a perpendicular YX to YZ and make XY equal, to some scale, to the length of the conductor in respect of which the spectrum scale has been constructed, join X by straight lines to the points along YZ representing the displacements of the phase angles. Then, if XY be graduated to represent intermediate distances between XY, the points of intersection of a line drawn through the appropriate mileage graduation with the lines from X to the phase angle markings along YZ (the spectrum scale) will give the displacement of the phase angles of the several harmonics at the intermediate distance in question as shown in the figure.

Unfortunately, it has not been possible to find time to make the complete calculations necessary for the determination of the amplitudes and phase angles of the sine waves from which the ordinary square-topped telegraph wave impulse is compounded. However, the ordinates of a complex periodic curve compounded of 100 pure sine waves having frequencies in the ratio of 1, 3, 5, 7, 9, etc., to 199 and amplitudes relatively proportional to 1, $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{7}$, $\frac{1}{9}$, etc., to $\frac{1}{199}$ have been calculated. It is assumed for present purposes that all these sine waves start from the same zero, with the same sign; the complex curve obtained by plotting the ordinates calculated on the foregoing assumption, and also the fundamental sine wave of the above series are shown in *Plate* I. The former of these two curves, it will be seen strongly resembles the shape of the square-topped telegraph curve.

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The speed of signalling on land lines varies considerably, according to whether manual or automatic machine transmission is employed. At one time Morse telegraph operators were expected to signal, by hand, at the rate of from 32 to 36 words a minute; it is believed that 28 words a minute is now considered a sufficient output per operator in this country. In the case of the automatic Wheatstone apparatus from 200 to 600 words per minute can be transmitted, by the use of a punched tape; the length of the conductor and its characteristics largely determine the maximum number of words per minute which can be transmitted in any particular case, but practical considerations often dictate that the output arrived at shall be much below the maximum obtainable. In the international Morse code four elements are, on an average, employed to form the letters, signals and symbols in use; the average number of letters in the words employed in the text of telegrams in the English language is approximately five, and, therefore, including the spaces 20 alternations are employed, on an average, to transmit each word in a telegram. Therefore in the case of hand signalling, at the rate of 30 words per minute, a train of complex periodic wave impulses, whose fundamental wave has a frequency $n=10$ per second, is propagated along a conductor. In the case of transmission by the automatic Wheatstone apparatus at the rate of 300 words per minute the fundamental wave has a frequency $n=100$ per sec. An inspection of the complex periodic wave shown in *Plate* I. creates an impression that higher harmonics than those of which it has been compounded enter into the composition of the square-topped telegraph wave impulse; so that in the case of hand signalling at the rate of 30 words per minute sine waves having frequencies exceeding $n=1{,}990$ per second are probably propagated at the transmitting end of a telegraph conductor, and in the case of transmission by automatic Wheatstone apparatus at the rate of 300 words per minute frequencies exceeding $n=19{,}900$ per second are probably present at the transmitting end of the line.

In the case of long-distance submarine telegraphy, the speed of signalling is naturally much lower than in the case of land lines. The formula sometimes used to ascertain the maximum speed of transmission on a submarine cable is $N=\frac{2700}{CR}$ per minute, where N represents the maximum number of decipherable signals which can be transmitted and CR is the product of the total capacity and resistance of the conductor; for example, the Brest-Dakar cable has a constant of $CR=7$ seconds, and therefore, the maximum speed of transmission on this cable is :—

$$N=\frac{2700}{7}=386 \text{ legible signals per minute.}$$
$$=19 \text{ words per minute.}$$

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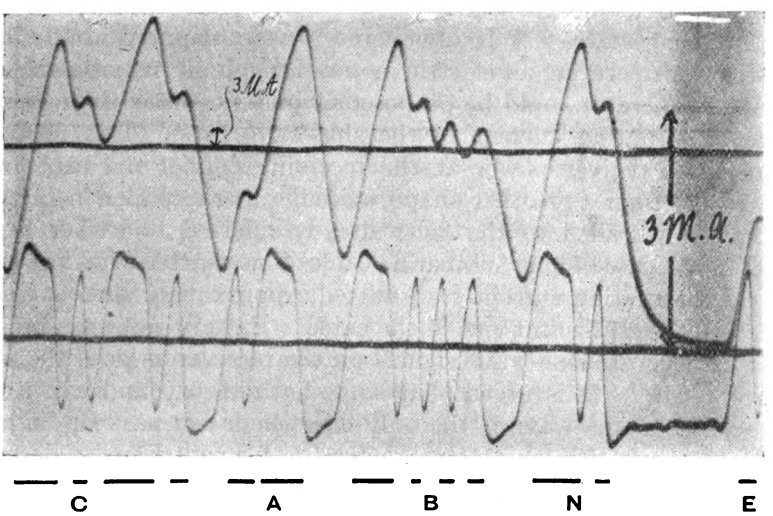
The speed of transmission on long submarine cables has been much increased by the adoption of the method of "curbed" signalling which is analogous to double-current sending on land lines, but even with this method of cable transmission when signalling at high speeds is resorted to, the elements composing the letters are apt to run into one another, and this is particularly the case with letters like "S" or "H" which are formed by three or four square-topped waves of the same sign, that is to say, even the delicate forms of receiving apparatus used in cable telegraphy are unable to resolve the separate impulses, and hence it is that highly expert operators are required to handle the received slips or tapes on which the incoming messages are recorded. Some idea of the degree of *distortion* which signals undergo during the process of transmission along a submarine cable can be gained from the accompanying oscillograph record which represents a few of the letters of the alphabet signalled

AS RECEIVED.



AS SENT.

according to the method adopted in land telegraphy. These signals were transmitted along one of the Anglo-German cables between the Norfolk coast and Borkum during some experiments carried out in 1910; unfortunately, details of how the circuit was made up are not available. It will be observed that the dash element of the letter which has a distinct squareness at top at the sending end has lost this characteristic by the time the wave impulse reaches the receiving end, where it arrives in the shape of an ordinary sine wave; whilst in the case of the dot element the very appreciable diminution

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in amplitude which this element undergoes in its journey can be clearly traced. The scale of the diagram is somewhat too small for utilization in connection with accurate calculations; however, it is possible to ascertain the difference in phase of the sent and received currents therefrom, thus the zero points of the dash elements of the letters A and B are found by measurement to be $\frac{30}{60}$ in. apart; if these zero points of the sent signals be projected on to the centre line of the received signals it will be found that the corresponding zero points of the same elements on the latter centre line are, on an average, $\frac{5}{60}$ of an inch apart; therefore the received current lags in phase in relation to the sent current by $\frac{5}{30} \times 360° = 60°$.

Recently a paper "On an Unbroken Alternating Current for Cable Telegraphy" was read before the Physical Society of London by Lieut.-Colonel Squier, PH.D. In this paper the practical problem of telegraph transmission is treated from a new angle of view. The telegraph engineer of pioneer days was restricted to the use of the source of energy which causes square-topped wave impulses to be propagated along a telegraph conductor; it is otherwise to-day. The author states: "If an engineer were required to design a system for operating an electric motor through an Atlantic cable, no form of generator could be proposed at present, other than a single-phase alternating current of the sine-wave type. This form, we know, will deliver power at the receiving end of the cable more efficiently than any other shape wave." In the paper in question attention is called to the fact, already referred to earlier herein, that in the case of long submarine cables "no matter what the shape of the alternating current transmitted, approximate sine waves are received at the distant end of the cable. Battery reversals produce just as accurate sine-wave signals on the receiver as does the alternator itself." It is urged that since both theory and experiment show that a sine wave is the only one which can pass through the cable without changing its characteristic form, it is most desirable that steps should be taken to alter the typical telegraph circuit so as to admit the employment of pure sine waves for telegraph signalling purposes; the harmonic waves, required to build up the square-topped wave, impressed at the transmitting end are absorbed in the cable itself, and never reach the receiving end, they represent merely a superfluous electrical charge which must, for each signal, be got rid of before the succeeding signal can be sent into a cable. Colonel Squier also points out that: "The opening and closing of an alternating current circuit is well known to produce disturbances of a more or less pronounced character, depending upon the angle of phase at which the current is opened or closed." And it may be remarked here that under present-day conditions, which render it necessary to place conductors for important telegraph and telephone

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circuits in close proximity to one another along the same routes, the disturbances of the nature referred to have been responsible for the rejection of more than one invention in the field of high-speed telegraphy; inventions, moreover, which otherwise possessed most desirable features.

The author of the paper in question advocates that the practice in regard to telegraph signalling should be put on a rational basis and with this object in view discusses the merits of a system of transmission in which it is proposed to utilise an uninterrupted alternating current of pure sine-wave form for telegraph purposes, this current being operated upon by the ordinary punched transmitting tape in such a manner as to alter the impedance of the transmitting circuit at the instants *when the current is naturally zero.* By this means the amplitude of the current flowing in the circuit can be varied in any manner desired at the most appropriate moment. In the system here advocated, each semi-wave of either sign represents the dashes, dots, and spaces: each of these elemental signals is formed by a current of different amplitude, the amplitude of the dot being made twice that of the space semi-wave, and that of the dash double the amplitude of the dot semi-wave; the semi-waves constituting a few of the letters of the alphabet are shown diagrammatically in *Plate* I.: in the diagram in all three cases the same letters of the alphabet are shown in the same sequence, but whereas the letters as signalled in the land and cable telegraphy systems occupy practically the whole interval equivalent to 50 units, it is possible to repeat the letters on the sine-wave system in the interval equivalent to 42 units on the same scale.

For purposes of comparison the methods of signalling in Morse Code on land lines and on long submarine cables are shown on the same Plate as the system of signalling proposed by Colonel Squier, and it will be readily recognized from an inspection of these diagrams that in addition to the other advantages likely to accrue much economy of time will also be gained by the use of pure sine-wave signals, as compared to that consumed in signalling with the square-topped wave signals.

The alternating currents received may be utilized either to trace the message on a tape by employing a siphon recorder or these currents may be employed to operate a siphon Morse printer, by means of an adaptation of Muirhead's gold-wire relay, or a Huntley magnifier and a local relay. The question of the "resolving power" or definition, in relation to the legibility of the letters signalled, is discussed in the paper in question; in it is also developed the fundamental principle of never metallically "breaking" the transmitter circuit; and a special form of dynamo, to operate at frequencies of from 4 to 10 per sec., which was used in carrying out experiments on an Atlantic cable is described.

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Although the problem of telegraph transmission is treated by Colonel Squier from the standpoint of long submarine-cable circuits, nevertheless he recognizes that the employment of the pure sine-wave impulse could, with advantage, be employed for signalling on land lines; not the smallest of these advantages would be the removal, in the case of the automatic Wheatstone system, of the making and breaking of the circuit at comparatively high voltage; the effect of its adoption would be, at a single stroke, to reduce very largely the inductive disturbances produced by high-speed telegraph circuits on neighbouring telephone and telegraph circuits, effects which often cause not only annoyance and trouble but also give rise to unnecessary expense. Another of the advantages would be that the possibilities in connection with the working of *superimposed* telegraph circuits on long-distance telephone trunk lines could be enormously increased.

In conclusion Colonel Squier points out "that certain characteristics are very desirable in any cable system, such as

(*a*). All signals should represent equal lengths of time.

(*b*). No two consecutive signals should be of the same sign.

(*c*). The resolving power or definition of each letter of the alphabet should be as nearly as possible the same.

(*d*). The total quantity of electricity measured in coulombs impressed upon the cable should be as nearly as possible equal to zero for any two consecutive signals."

Finally, attention is drawn to the fact that "the ideal solution for power transmission automatically comprises each of these conditions, and, in addition, has other advantages in safety to the cable property from undue electrical strain throughout every centimetre of its length." It is undoubtedly the case that the system of signalling by alternating currents proposed above goes far to meet the above-mentioned requirements.

The angle of view from which the subject of telegraph transmission has been considered here provides, it is thought, a strong argument for the abandonment of the arbitrary square-topped wave impulse hitherto in use for telegraph signalling purposes, and for the adoption in its place, both in the case of land lines and in that of submarine cables, of the more scientific, and therefore more efficient, pure sine-wave impulse.

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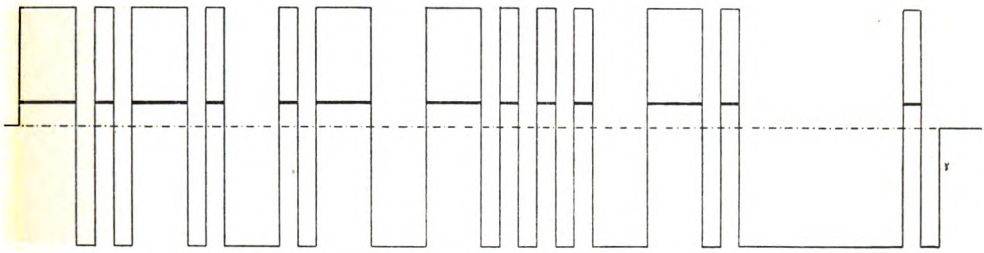
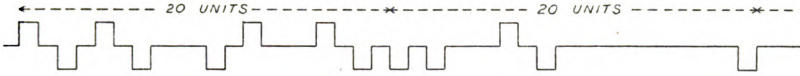
TELEGRAPH TRANSMISSION.

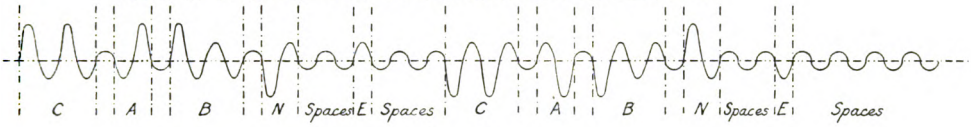


LETTERS IN MORSE CODE AS SIGNALLED IN LAND TELEGRAPHY

20 UNITS — 20 UNITS — 10 UNITS



LETTERS IN MORSE CODE AS SIGNALLED IN CABLE TELEGRAPHY



LETTERS AS SIGNALLED BY THE SINE WAVE SYSTEM

20 UNITS — 20 UNITS — 10 UNITS

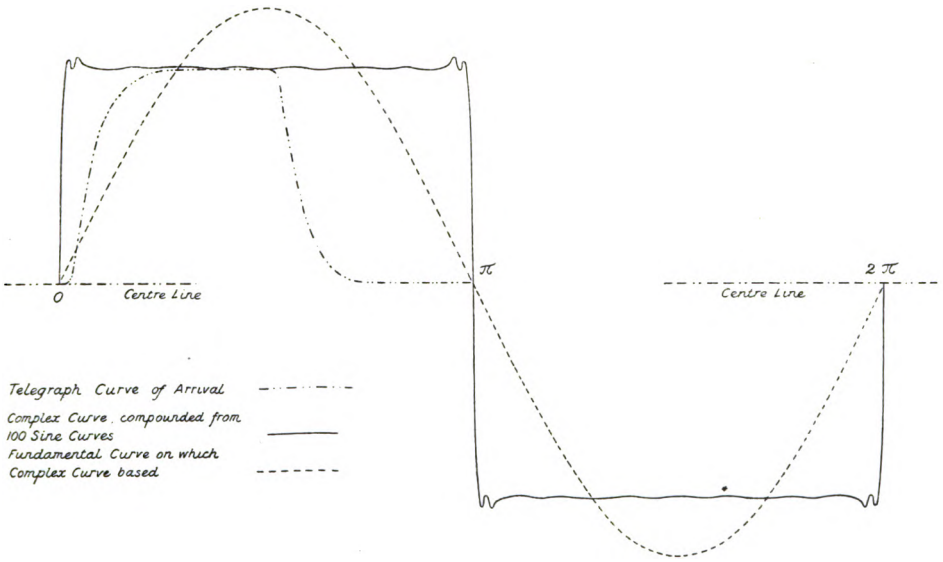


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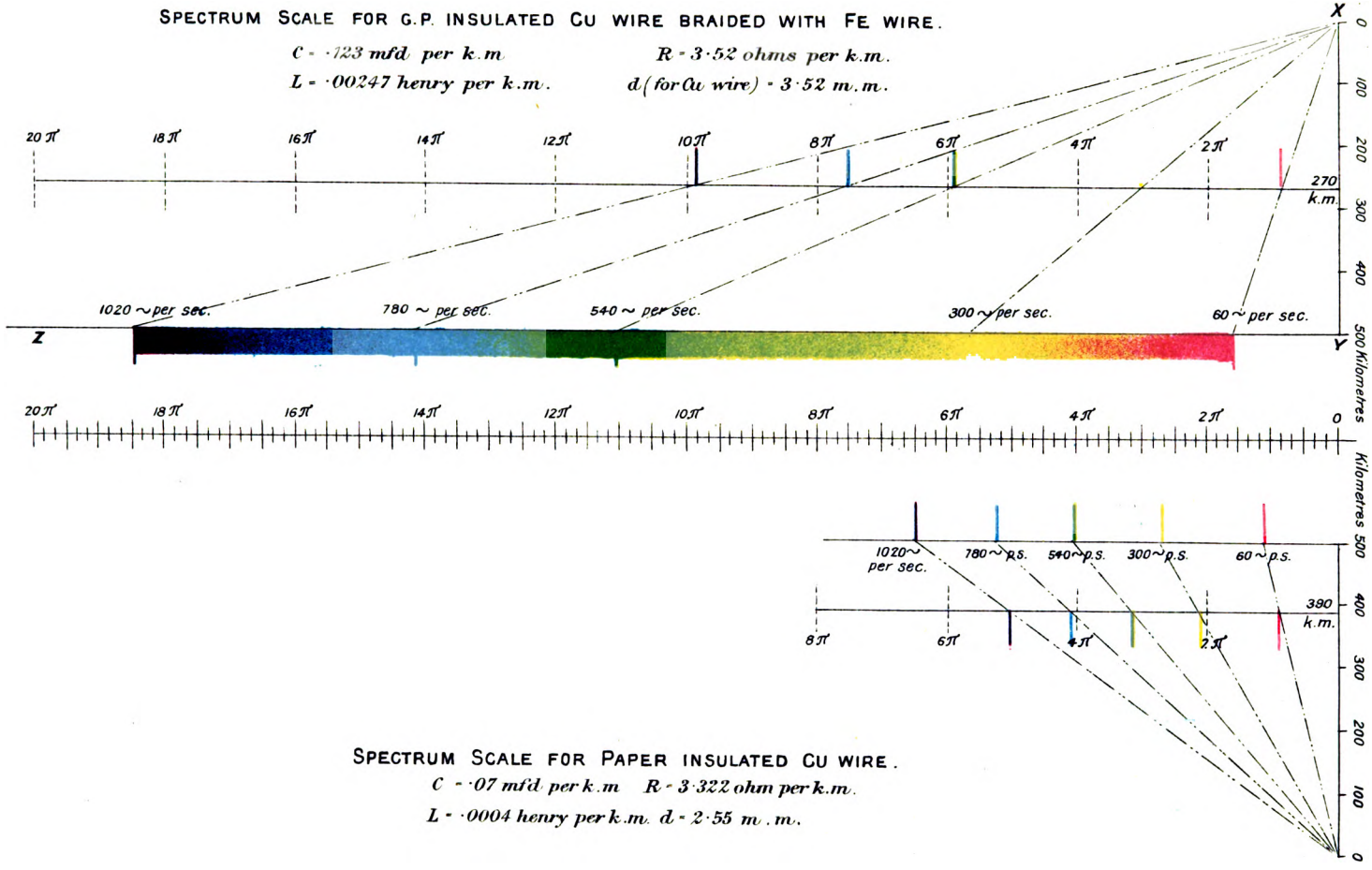
PLATE II.



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SOME FUTURE DEVELOPMENTS IN HEATING AND VENTILATION.

By A. H. BARKER, ESQ., WH.SC., B.A., B.SC.

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IT is somewhat surprising, in view of the immense importance to mankind of the twin sciences of Heating and Ventilation, that the amount of attention hitherto paid to the scientific aspects of these subjects, both on the part of the scientific man and of the engineer, should have been so small. The subject, indeed, is hardly seriously regarded as capable of scientific treatment by the average engineer, who probably looks on it as a branch of plumbing or building, calling for a certain knowledge of rule of thumb and a certain amount of practical experience, but at the same time hardly a fit subject for the scientific engineer. Although the science of this subject is yet in its infancy, the author is anxious to secure a more just recognition of its position as a serious branch of engineering, and takes this opportunity to explain to his brother engineers how and why this view is a totally erroneous one, and to discuss the general nature of some of the problems yet unsolved. It may safely be said that there are more unexplored problems of science and greater difficulties attending their solution in the case of heating and ventilating than in almost any other branch of the profession, and the author has had some experience of a good many. In Germany, that uninspired land of detail, where the minutiæ of the subject have been thrashed out with a meticulous care which seems to us to be almost absurd, the real essence has been entirely missed.

This erroneous view of the science as a mere matter of rule of thumb has been fostered in the past by the extremely unscientific manner in which the subject has been treated by writers of technical books in America and England. Any educated engineer studying some of this literature must be driven to the conclusion that there is really no science whatever in the subject.

The reasons why it has failed hitherto to come up to the standard attained in other branches of engineering are not difficult to understand. They are the immense complexity of the factors which go to make up any given result, the difficulty of defining in terms of exact science what that result is or should be, the fact that the

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criterion of success up to the present has, of necessity, been the feelings of individuals rather than the readings of scientific instruments. Added to these is the immense power of adaptability of the human organism to varying conditions, which tends to make actual variations of conditions appear unimportant in practice. The circumstance which differentiates this branch of engineering from almost all others and at the same time introduces difficulties unknown in all other branches is that we have here to take account of the variable human factor, both as to its physiology and its psychology, as an essential part of the problem. In this sense we trench on the domain of the physiologist and hygienist to a degree unknown in any other branch.

It is easy to understand that this combination of difficulties tempts the busy practical man to be satisfied with any sort of result, and to leave to Nature the task of adapting the organism of the sufferer to the conditions produced by the engineer—a task which she can often accomplish, but often not without injury to the individual. The present lack of exact knowledge makes it difficult or impossible to hold the practical man to any precise standard of accomplishment. In other words the practical man can get along somehow, with a very small modicum of knowledge. It is the general attempt to do so which has led to the undoubted state of discredit in which this branch finds itself to-day.

All engineering is merely glorified common sense. The training of an engineer leads him to try to deal in a commonsense way with objective facts as he finds them. In this branch the first obstacle is the great difficulty of finding what are the facts.

Consider for instance the first problem which would meet a scientific engineer endeavouring, without previous experience, to arrange a satisfactory scheme of ventilation for a building. He would commence with the assumption that the artificial ventilation of a building consists in forcing in a calculated volume of air, a task which, if he were familiar with fans and the laws of the flow of air in ducts, he might think he could easily accomplish. After he had made one attempt to satisfy the occupants of the building by proceeding on the assumption that this is the only requirement, he would find out that one essential factor in the problem was to study the distribution of the air currents in the building itself.

Even in a small building, this is in itself a problem of very great difficulty. Although each one of these currents obeys laws of nature as rigidly accurate as any other laws of nature, yet the number of influences having an effect on the air currents is so enormous that the complexity of the result is almost immeasurable. In the attempt to lay down in terms of exact science the laws which govern this result, any person might well be baffled and unable to trace with any clearness the operations of any law at all. The reason is, of

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course, not that the law is not there, but that it is so complex that it would take almost a superhuman intellect to analyze it completely.

Further, who can say what system of air currents in a room—say a theatre—is to be aimed at? We all know that complaints of the ventilation of almost every public room are universal. Yet there is no general agreement, either what is wrong or what is needed to put it right. How is it possible to hold the ventilating engineer responsible for a poor result when no one can specify what the result ought to be?

I have made reference to the complexity of only one of the constituents of ventilation. Those of heating are no less complex. We have two totally distinct forms in which heat is delivered into the room, namely, convection currents of heated air and radiant energy. These are as distinct from one another as light is distinct from sound. Yet, up to the present, no formal recognition of their entire separation from one another has been recognized in current literature. The cause for this is easily seen to be that, different as these two forms of what for convenience we call heat are from one another, yet they can be instantaneously transformed from one to the other and back again. Their measurement, again, is not a problem to be easily solved. No sooner does one measure the amount of radiant energy than the mere act of measuring it turns it, or part of it, into convected heat.

The difficulty, however, which is the most baffling in the attempt to reduce this subject to an ordered science is the fact that the object of both heating and ventilation though primarily physiological, is also to some extent psychological. The primary object is to keep the inhabited rooms healthy; of almost equal importance is the necessity to keep them comfortable. The effect of any given condition on the human body is, if possible, more complicated than the laws which govern air currents and heat flow. The physiologist cannot yet tell us in exact terms what are healthy conditions for inhabited rooms. He can give us generalities only, and the experiments on which even these generalities are based are far from convincing. He cannot even, for instance, tell us what is a healthy temperature for human beings to live in, nor does he seem to realize that when he speaks of "the temperature of a room" he means merely the temperature of a thermometer suspended in the room.

Some physiologists say (and the author agrees) it is desirable in the interests of health that the temperature maintained should be as low as a human being can endure without real discomfort. Yet others will say this is nonsense, that the room should be so warm that the man feels comfortable without any effort. Neither can anyone tell us within 300 per cent. how much fresh air per head per hour is the minimum consistent with health. Indeed, as a fact, such a crude statement would have no meaning in the real

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science of the subject. It depends on the temperature, humidity, and a score of other things. Physiologists cannot agree as to the chemical nature of healthy and unhealthy air. Books on the subject of climate do not give any explanation of what physical conditions constitute a bracing or a relaxing climate. Indeed most of the hygienists do not seem to realize that such words need any further description.

The matter is yet more complicated when we consider that one object the heating engineer has in view is to make persons comfortable. We here come across the baffling fact that a man is comfortable when he thinks he is comfortable. If we can make him imagine he is comfortable without the alteration of any single condition, we can make him feel comfortable. Make a man imagine he is cold or feels a draught, and he will at once want to shut all the windows. Convince him on the other hand that to shut the windows is unhealthy and stuffy, and the same man will not be comfortable unless the windows are open. One can train oneself to feel comfortable in anything.

In further illustration the author will refer to a psychological experiment he made on a medical man who was a guest at his house some years ago. We were sitting in a room which had a thermometer suspended on the wall. The visitor made some remark about a "shoemaker's wife" and complained of the room being cold. It was freezing outside: the thermometer on the wall read 54 degrees, and was a correct one. The author's view is that such a thermometer reading is quite consistent with health and comfort, when it is freezing outside. We fell to a discussion of temperatures, and it was suggested, as an experiment, that the temperature of the room should be gradually raised until the guest felt comfortable, to ascertain whether he found a temperature of 60 degrees too high. The room was provided with a fairly powerful heating apparatus. The author went into the cellar, pretended to stoke up the boilers and to turn the radiator full on. As a fact, nothing was done either to the boiler or the radiator, though the doctor was allowed to hear the clattering of the fire-doors and fire-irons. After a short interval the thermometer was changed unobserved by the visitor, for another precisely similar in appearance which read 6 degrees too high. When it had been placed on the hook without his seeing the change, it was shown to him, and he was asked whether that temperature made him more comfortable. He said the temperature was then just right for him, neither too hot nor too cold, although the real thermometer reading was precisely the same as it had been in the earlier part of the evening. That little experiment is most illuminating as showing the extraordinary difficulties attending an attempt to treat this subject scientifically.

It is an undeniable fact that a room filled with air which, so far

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as chemical analysis can detect, is absolutely pure may *feel* very stuffy. For instance, the House of Commons, on the ventilation of which the author has experimented for many months for the Committee of the House, the air in the Debating Chamber is, chemically speaking, as pure as in any room in the world. Fresh air simply pours into it in extravagant volumes. In a moderately full house there are no less than 13,000 cubic feet of air supplied per head per hour. Yet it produces, without any possible doubt, the effects which we are accustomed to think of as associated with defective ventilation—lassitude, sleepiness, infection and so forth. Complaints are loud and quite general.

A room may, on the contrary, feel fresh and sweet in which, judged by chemical standards, the air is very bad. The author has analyzed air containing 25 volumes per 10,000 of CO_2 which felt as fresh as a spring morning, although 10 volumes is regarded as the extreme allowable impurity in current science. There must be some combination of chemical or physical conditions which accounts for the effect so far as it is objective—when it is purely subjective, of course, it is impossible to analyze the effect. Nobody up to the present has ventured to specify what is that combination.

Now the future of the sciences of heating and ventilation depends, on the scientific side, on the further analysis of the conditions which produce the feeling of comfort and other effects. On the practical side they consist of the application of those discoveries so as to bring under control each of the conditions, and on the further developments of economy of construction and transmission and the better control of the forces we bring into play. Before we can get a step further we must be able to express, in exact terms, each of the chemical and physical conditions which go to make up the sum total of the room condition.

The criterion of our success, as I have said, is, and must be the effect on the feelings of an individual. But, we must, in order to give this subject a scientific basis, be able to translate the feelings of an individual into terms of measurable physical conditions, and this is our first difficulty. We may lay down certain physical conditions which we conceive to be necessary to the production of comfort and health, and we may direct all our attention towards producing those conditions. We may succeed completely in doing so, and find that when we have done it that some individuals will find that those conditions are not such as are necessary for their personal comfort. We may then get other bases to work upon and still find that the new bases themselves are not any more suitable than the first.

It is clear that the only legitimate function of the engineer as such, is to produce and control certain specified conditions. The criterion of his success must not be the self-contradictory feelings of the occupants of a building, but they must be the exact readings of

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well-defined measuring instruments, such as radiometers, hygrometers, air meters of various kinds, apparatus for the analysis of air, dust counters, thermometers and other instruments.

The other half of the problem is for the physiologist and the hygienist, viz.: to specify what are the conditions which will be regarded as healthy and comfortable. It involves essentially experiments on human beings, which are in their very nature illusory and extremely difficult. In essence they are, in reality, so many attempts to calibrate human beings. The science of the subject is only in its infancy as yet. The instruments brought for your inspection to-night have been designed mostly by the author in an effort to arrive at a clearer basis for analyzing these problems, for future developments depend on this analysis to no small an extent.

Let us consider first the problems of heating stated in general terms. The practical problem before the engineer is to introduce heat into a building in such quantity and in such form as to make the building comfortable. It will be evident that as heat can be introduced in two different forms, namely by convection currents and by radiation, there will be at least two corresponding conditions as to temperature in a room which must be observed by the heating engineer. The very existence of these two conditions has received no recognition in any of the classical literature on the subject. Indeed, as has been previously remarked, it does not seem generally to be clearly understood what is the meaning of the expression "temperature of a room."

This expression is commonly understood to mean the reading of a correct thermometer suspended in the room. Now a thermometer suspended in a room does not indicate the temperature of the air surrounding it. It is also largely influenced by the amount of radiant energy impinging on the bulb, which has no connection with the air temperature. For instance, one sees in the winter time the caretaker of the tools used in road-mending operations seated in a sentry box before a coke fire quite comfortably, although the air surrounding the fire on all sides is sometimes far below freezing point. A thermometer suspended near the fire will obviously read fairly high, although the temperature of the air surrounding it on all hands may be far below freezing point. It is well known that the radiation passes through the air without warming it. This is an extreme example of this phenomenon, but it brings clearly into prominence the fact that a thermometer indicates its own temperature only, when it is hung up in a room. It clearly does not necessarily indicate the temperature of the surrounding air, neither does the reading of a thermometer form any reliable guide to the feeling of cold or warmth in a room or out of doors. The problem has been treated in the past as though all that was necessary was to introduce heat in any form sufficient in quantity to cause a the

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mometer suspended in the room to read a certain figure say 60° or 65° F. There is no problem at all in that—anybody can do it. One can procure a radiator of suitable size, which is easy enough to calculate, and a suitable boiler, connect up with piping and there you are! It is true that there is a very great deal of calculation involved in so designing a large system of pipes that the flow to all parts of the apparatus shall be uniform and proportional. But even when this is done there are undoubtedly a great and increasing number of persons who say they cannot endure what they call "apparatus heat" in any shape. They cannot say why—and very few people can tell them why. Theories that the heat is a "dry heat" are absurd. Radiator heat is no more dry than any other form of heat. The heating engineer says: "There is your thermometer reading 60°—a beautiful moderate temperature—what more do you want?" The man says, in effect, "I do not know what I do want but I do *not* want to be stifled and I do *not* want to be cold. Can you not give me heat which keeps me warm without choking me?"

Now, that is a very real problem of which we must get to the bottom. Why is it that radiator heat is so distasteful to many persons? How far do imagination or psychological influences account for it? Obviously a careful analysis of room conditions must involve an investigation of all these matters.

It is evident that the first thing which should be analyzed in the endeavour to arrive at the actual temperature conditions of a room is both what is the temperature of the air itself and what is the temperature corresponding to the radiant condition. The author has introduced a conception which he has named the "radiant temperature." The idea of it is the temperature which a thermometer would register if there were no air in the room at all, a sort of mean of the temperature of the surrounding walls.

As an illustration, consider the following:—In an ice cave in a glacier, in Switzerland or elsewhere, on a very hot day, the radiant temperature in the cave is obviously 32° F., but the air temperature near the mouth of the cave will exceed 70° F., yet a thermometer at this point might probably read 56°.

Or again, conceive a room heated on a cold day by blowing hot air into it. Here it is evident that the hot air is the sole source of all the heat supplied to the cold walls. The air must therefore be hotter than the walls. The radiant temperature must be lower than that of the air.

On the other hand, when a man keeps warm while sitting in the cold open air in front of a coke fire devil, the radiant temperature must be higher than that of the air.

What is the nature of the physical effect of these two different conditions on the human body, and what is the effect on the sensa-

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tions? Please note that the physical effect is a different thing from the sensations produced. It is necessary to investigate both. How far does the difference account for the complaints we hear of the stuffiness of radiator heat or of the lassitude produced by the plenum system. How far is either related to the rate of heat loss from the body of a human being? Does that rate of heat loss absolutely condition the degree of comfort experienced? If not, what other effect is there?

To make a systematic beginning of unravelling this tangle of questions we must first develop experimental means for recognizing and measuring the four different quantities, air temperature, radiant temperature, quantity of convected heat, and quantity of radiant energy.

Even before this is done it is necessary to determine experimentally what is the relation between the thermometer reading, the air temperature, and the radiant temperature. An extended investigation on this point has been made at the University College. We have also devised two instruments for separating the air temperature and the radiant temperature. These instruments are now on the table. They are far from being ideal instruments for the purpose, as they are both expensive and difficult and very tedious to manipulate. Something of a much simpler character will be necessary before we can say that this problem has been satisfactorily solved in a practical manner.

The principle of these instruments is comparatively simple. Essentially they are modifications of the same instrument.

The first (*Fig.* 1) has as its object to ascertain what is the mean temperature of the surfaces of the walls of the room and of the furniture and of all the exposed surfaces the temperature of which have an effect on the bulb of the thermometer. The principle of the instrument is to surround a delicate thermometer with air at the same temperature as that of the room, and also to envelop it on every side with a surface whose temperature can be adjusted to any degree and to an absolute degree of uniformity. This is secured by making a double-walled vessel, filled with water between the two walls, and providing means for heating it and stirring it powerfully. One delicate thermometer is inserted into the water-jacketed space and another into the water. The temperature of the water is then adjusted so that the inner thermometer reads the same whether it is surrounded by the water jacket or suspended freely in the open room. The temperature of the water is then clearly the "mean radiant temperature."

The elaborate parts of the apparatus are the means suggested by experience for ensuring that the thermometer is actually surrounded by air of the same temperature as in the room (for, of course, contact with the warm or cold sides of the apparatus will affect the tempera-

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ture of the air) and for stirring up the water and for convenience of manipulation.

To take the reading of this instrument in practice is not so simple a matter as it looks on account of certain difficulties which need not be further discussed.

Air Temperatures.—The instrument for finding the temperature of air (*Fig.* 2) is similar in general principle, but is a direct-reading instrument. It is constructed on the principle that if a thermometer is surrounded not only by air at the same temperature as the air in the room, but also by double-walled surfaces at the same temperature as the air, the thermometer will read exactly the temperature of the air. That is, if the radiant temperature is artificially made identical with the air temperature, both will be the same as the thermometer reading. The identity of the temperature of the air in the instrument and the air in the room is obtained by measuring its density by a very delicate chemical balance. Any convenient method may be adopted for regulating the temperature of the water in the instrument, which is gradually raised until the density of the interior air is identical with the room air. The author claims to have proved by the aid of these instruments that the stuffy feeling which is often associated with systems of central heating is due largely, but not entirely, to the fact that the air temperature is too high and the radiant temperature too low. On the other hand, the freshness of a building depends on keeping the air temperature relatively low and the radiant temperature high.

It is fundamentally for this reason that a room warmed by an open fire is by many sensitive persons often felt to be much more comfortable than a room heated by a radiator. It is not necessarily due to the fact that the ventilation produced is more liberal except in so far as a continual inflow of cold air into a room tends to keep the air temperature low. If, for instance, we have in a room at the same time some means, such as an electrical stove, for generating a good deal of radiant energy, and at the same time in the room a coil supplied with a circulation of cold brine for keeping the air cool, we should get in the room conditions in some respects similar to those obtained by a warm fire and an inflow of cold air. It is the *temperature* and humidity of the air which are the important points, and not its chemical freshness or freedom from CO_2 or other organic products.

Dr. Leonard Hill has shown by experiment that physiologically speaking the chemical composition of the air has within wide limits no effects whatever on the human organism, and the author's experiments bear out that fact from another point of view. Dr. Hill believes that the effect of ventilation is so largely a question of the rate at which heat is abstracted from the human body that all other effects combined are of comparatively small importance. He has

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devised two instruments to determine this rate of heat loss in any conditions.

The first of these is essentially a calorimeter consisting merely of a thermometer with a very large bulb. It is used by noting the rate of fall of temperature when raised approximately to the temperature of the human body and placed in the conditions which are under investigation. The rate of fall of temperature gives a measure of that at which heat is lost from the body.

A second and much more elaborate instrument is called the "caleometer." This is an electrical instrument which measures the rate of expenditure of electrical energy necessary to maintain a coil at the approximate temperature of the body. If Dr. Hill's view is correct, the indications of these instruments are practically all that is necessary to determine whether the point at which they are placed is in a satisfactory condition as regards ventilation. The author believes that though this rate of heat loss is no doubt of very great importance, yet there are many other conditions almost equally so. One of the chief is *the way* in which this surplus heat is abstracted. According to this view the proportion of the heat which is abstracted by contact of cold air with the body is of vital importance to the nervous sensations produced. It causes a great difference in effect whether the heat is abstracted by radiation or by contact of cold air. This, again, is a problem of combined engineering and physiology which calls for a most difficult investigation.

In connection with this investigation it is obviously very important to be able to separate the amount of heat communicated to a room as radiant energy from that as communicated by warming the air. We have designed and erected at the University College an apparatus (*Figs.* 3 and 4) for this purpose, which has some points of interest. The heater under test is placed underneath a canopy which collects all the warm convection currents proceeding from it. A delicate electrical method is applied for testing its quantity and also its temperature. The stove is surrounded by radiant heat meters, such, for instance, as Smith's radiometer and thermopiles. The intensity of the radiation in any direction is thus obtained and plotted on polar diagrams (*Fig.* 5), and a balance sheet of the whole heat given off can be obtained with some accuracy by mechanical integration. The same apparatus is applied to the investigation of the heat given off by a water and steam radiator.

It will be understood that the above determinations (which are only a small part of the problems confronting the heating engineer) have had reference only to the measurement of the physical conditions of a room. They do not touch the question of the effect of these varying physical conditions on the body or the sensations of a person subjected to them. That is an aspect of the matter which, as has been said above, cannot be adequately

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treated by the engineer. It is essentially a problem of experimental physiology.

It will be evident also that the problems of heating and ventilation are closely associated. We cannot even consider problems of heating without simultaneously considering those of ventilation. We have, for instance, to consider the effect on the human organism of warm air and cold air. In this connection some very interesting experiments have been made by Dr. Leonard Hill in which he has studied the difference in the effect on the organs of the body of hot and cold air by actually inspecting those organs by optical instruments under different air conditions.

A further important point in connection with ventilation is to determine the effect on the human organism of different quantities of dust in the air. The investigation of such a matter naturally imposes on us the necessity of determining with some accuracy how many particles of dust do exist in a particular sample of air. As this number runs into millions per cubic inch, it will be evident that very special methods are required for counting them. The "Aitken" dust counter (*Fig.* 6) effects this, being based on the principle of measuring off a certain minute sample of air, and diluting it largely with a measured quantity of pure and dustless air. A certain fraction of this enlarged volume is measured off. The whole of the particles of dust in this fraction are deposited on a glass plate underneath a microscope and a measured fraction of these particles is actually counted. By multiplying up the total number in a cubic inch the original sample can be calculated. The method by which the particles of dust are deposited is to surround each with a globule of condensed moisture which so adds to the weight of the particle that it sinks and adheres to the plate.

The measurement of the dust particles is clearly only one side of the problem. We have also to measure the effect of different degrees of dustiness on the human organism. That is obviously a matter of great difficulty and concerns the physiologist and is more appropriate to the physiological than to the engineering laboratory.

In no respect has the science of heating and ventilation been more backward than in the knowledge of laws governing the movements of air. If we compare, for instance, what is known of the laws of electrical currents with the corresponding laws of pneumatic flow, we shall see that in the one case the knowledge is for practical purposes complete and definite, enabling calculations to be made with the utmost precision and, what is more important, enabling the results of the calculations to be carried out in practice.

Pneumatic matters on the other hand have been treated with almost a casual indifference by the engineer. One reason for this is, no doubt, the fact that the effects of electrical flow can be exactly and precisely traced by self-contained instruments, often or generally

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of direct reading type. The flow of air, on the other hand, is not only extremely difficult to measure, but also very erratic. Further, it is not so vitally important to be able to measure with close accuracy the flow of air as is the case with electricity. No man will be suffocated if he gets 10 per cent. less air than was calculated. It would, indeed, be very difficult to show, experimentally, within 10 per cent., how much air he was actually receiving. But if a dynamo gave 10 per cent. less electrical power than was calculated on there would be trouble. It would be quite easy to show that the maker of the dynamo had failed in his undertaking.

The flow of air is brought about by the operation of very trifling momentary causes constantly varying. So no doubt is the flow of electricity in relatively large quantities at low voltages. The ventilating engineer is concerned with a comparatively large flow of air at very low differences of potential. The problem is comparable with the investigation of the flow of electrical currents in a large mass of metal. If, for instance, we take a cube of copper measuring 3 ft. in every direction, the electrician would find very great difficulty in investigating the electrical currents throughout the mass. Some local circuits would no doubt be set up by any accidental distribution of electro-motive force, such as those set up by the movements of a magnet in the neighbourhood. This exactly corresponds to the problem with which the ventilating engineer is confronted in ventilating a building. Air is introduced, for instance, into a room at a certain point. At other points in the room, sometimes near, sometimes remote from the point at which the air is introduced, currents of air are experienced which the occupants of the room call "draughts" which may, or may not, have something to do with the manner of its introduction. It is held up as a reproach to the ventilating engineer that these draughts exist, and so no doubt it is. He is told that he does not understand his business, because these draughts seem to be erratic, and that he cannot exactly control them. Yet the laws of pneumatics, little as they have been studied, are quite as definite as are those of electricity. The difficulty is that the conditions are so difficult to gauge and to control. The laws of pneumatic resistance have been put forward by the investigators in such a form that they are somewhat difficult to grasp by the comparatively non-mathematical mind of the engineer. The form which the fundamental law of pneumatic resistance in a flux commonly takes is as follows :—

$$p_1 - p_2 = \rho \frac{lc}{a} \frac{v^2}{2g} + \Sigma \zeta \frac{v^2}{2g}$$

Comparing this with the corresponding fundamental law in the electrical field (Ohms law), E=CR, the simplicity of the latter is at once apparent.

We are making an effort at the University College in the Depart-

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ment of Heating and Ventilating Engineering to develop experimentally the laws of pneumatics on a somewhat similar basis to those of electricity as first suggested, the author believes, by Dr. Shaw. We are taking the fundamental formulæ in a form exactly comparable to Ohms law, viz. :—

$$H=RQ^2$$

and experimentally testing the validity of this law in all kinds of pneumatic flow.

This involves first the evolution of standard units of pneumatic measurement comparable with those of electrical science. For instance the unit of aero-motive force is naturally a foot of air column or that difference of pneumatic pressure against which it would require one foot-pound of work to force one pound weight of air. The unit of flow (Q) is naturally one cubic foot of air per second. The corresponding unit of resistance is closely equal to the resistance of a round hole 6 in. diameter in a flat thin plate. The connection between these units is that a pressure equal to one foot of air column will cause a flow of one cubic foot per second through a round hole in a flat plate 6 in. diameter.

Now, obviously, if we can compare all pneumatic resistances with this unit, we shall be in a very much better position to understand the flow of air than we are at present, having to work with relatively complicated formulæ such as have been indicated. The fundamental difference between the laws of pneumatic flow and those of electrical flow are that in the pneumatic case the aeromotive force is nearly, but not exactly, proportional to the square of the flow, whereas with electricity the electro-motive force is exactly proportional to the first power of the flow.

This introduces certain differences into the mathematical treatment of the two problems, but these differences are not sufficient to exclude from possibility the application of some similar experimental methods.

We have, for instance, made a large apparatus, the pneumatic analogue of the Wheatstone bridge, for the determination of pneumatic resistances, and sundry methods of battery resistance have been applied to determine the internal resistance of a fan.

The great importance of this method to the practical engineer will be at once obvious. If for instance, we can specify the proper resistance in pneumatic units for a boiler flue and chimney we shall be in a position to deal on a rational basis with the much-vexed problem of chimney shafts, which problem has only been treated in the most incomplete and perfunctory manner up to the present. We can determine by the application of these rules what is the actual resistance of a boiler flue, and are able to tell exactly what is the maximum capacity of a plant in heat units or in pound of steam, even without lighting the fire in the boiler.

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The method by which this is done is exactly analogous to the potential method of determining battery resistance, namely by introducing into the battery circuit a number of different resistances which can be exactly measured and observing the currents produced in each case. To apply this method to the determination of the resistance of boiler flues and chimney shaft it is only necessary to adapt a fan to the air inlet to the boiler through a chamber in which a constant low pressure of air can be maintained. An adjustable resistance between the fan and the boiler inlet is then altered and the current measured in several cases from which the pneumatic resistance can be at once established. It is easy to show, for instance, that the total resistance of a plant consisting of say, three Lancashire boilers, 28 ft. by 7 ft. 6 in. should be about ·00172 units of resistance with a chimney height of 100 ft.

It is even possible to determine the value of the resistance without a fan, without even an anemometer, but having a very accurate micrometer pressure gauge. The method by which this is done will be apparent from the diagram. We need measurements of the mean temperature in the chimney from which we can determine the total aeromotive force by calculation. By measuring with accuracy the pressure in the chambers marked A and B (*Fig.* 7) due to the pull of the chimney shaft, it is possible to determine exactly the flow of air through the flues at any given moment by calculation only. A very small amount of calculation will then determine the resistance of the boiler flues and shaft in pneumatic units. The same factor may be determined by graphical methods first suggested by Dr. Shaw (*Fig.* 8).

We have applied the same system in practice to a number of other important determinations. We have found, for instance, the relative resistance of different types of ventilating gratings and flues of different radius and shape. The method, indeed, is capable of very wide extension.

This paper has dealt sketchily and, possibly, very inadequately with a few only of the multitudes of problems with which the real science of heating and ventilating engineering is concerned. Enough has been said to show to engineers that there is a good deal more in this subject than such a collection of mere rough rules of thumb as are to be found in the current literature, and that the subject is well worthy of taking its place among the most difficult of practical science. It is largely because scientific engineers have not, hitherto, taken this subject seriously that it is in a very backward state. It is at the present time in something like the condition that mechanical science was in at the time of Newton or electrical science at the time of Faraday. It would be very much to the advantage of mankind if engineers would take the subject more seriously.

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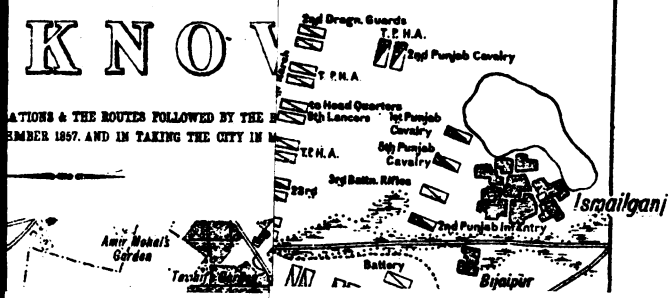

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SIEGES AND THE DEFENCE OF FORTIFIED PLACES BY THE BRITISH AND INDIAN ARMIES IN THE XIXth CENTURY.

(*Continued*).

By COLONEL SIR EDWARD T. THACKERAY, V.C., K.C.B. (LATE R.E.).

THE CAPTURE OF LUCKNOW, APRIL, 1858.

In December, 1857, Sir Colin Campbell commenced to concentrate his forces for the final operations of the capture of Lucknow; and it was at this time that the outlines of his plans were drawn up. In a memorandum to Lord Canning, dated December 22nd, 1857, Sir Colin wrote:—

"Colonel Napier has given his deliberate opinion in which I coincide as regards numbers, that 20,000 men will be necessary for the first operation of subduing the city. That having been performed, it will be necessary to leave a garrison in occupation, consisting of at least 10,000 men, viz. 6,000 in the city, and 4,000 in a chain of posts on the Cawnpore roads, until the whole province should have been conquered, and the rebels driven out of their last stronghold."—(*Life of Lord Clyde*, Vol. II., p. 68).

Early in January, 1858, Colonel Napier returned to his post as Chief of the Staff to Sir James Outram at the Alumbagh, where that General had been left with a force to hold the ground pending the return of Sir Colin. Whilst there he soon formed the opinion that the attack should be made on the east side, accompanied by a flank movement on the north across the river Gúmti, which would take the enemy's fire in reverse. He therefore devoted the intervals between his arrival at the Alumbagh, and that of Sir Colin with his force, to a careful inspection of the ground on both sides of the river. The following reasons for these views were published in the *Professional Papers of the Corps of Royal Engineers*, Vol. X., New Series, 1861, p. 68.

"The east side offered: first the smallest front, and was therefore the more easily enveloped by our attack; secondly, ground for planting our artillery, which would be located on the west side; thirdly, it gave also the shortest approach to the Kaiser Bagh, a place to which the rebels attached the greatest importance; more than all, we knew the east side and were little acquainted with the west."

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Everything was decided in accordance with Napier's view, and on the 10th he was appointed to the command of the Engineer Brigade.

The city of Lucknow being upwards of 20 miles in circumference, it was utterly impossible to attempt an investment or a siege under ordinary conditions. The town is bounded on the north by the Gúmti, and on the east by a canal which runs northward from that river. About halfway between the canal and the Residency stands the King's palace—the Kaiser Bagh. This was the citadel of defence, and was covered by three lines. The first was a flanked rampart on the main side of the canal, which formed a wet ditch to it. The second, with a circular trace, enclosed a large building called the Moti Mahal, whilst the third consisted of a line of rampart to the north of the citadel. The first and second lines rested on the river to their left, and terminated on the right in the town itself, where it was impossible for an enemy to advance or turn them. Indeed, the only possible point of attack was from the east, supported by a corresponding advance on the other side of the river to take the lines in reverse. In front of the canal, and about a mile from it, was an extensive block of buildings called La Martinière, about 5 miles from Alumbagh.

Lucknow at this time was in the hands of the rebels, and had been occupied by them since the removal of the garrison with the ladies and children by the relieving force under Sir Colin Campbell. The Alumbagh, distant about 3 miles from Lucknow, however, was still held by a garrison under Sir James Outram, consisting of 4,000 men. At Futtegurh there were about 5,000 men at this period, and about 3,000 on the Ramganga. Materials had been collected to form a bridge to cross this river, but the orders to cross were not issued.

A serious attack had been made on General Outram's position at the Alumbagh on the 16th January. In the morning a body of the enemy, of which the strength is not mentioned in the dispatch, led by a Hindu fanatic, attired to represent the Monkey-god, made a sudden attack on the Jellalabad half-way picquet, at the time commanded by a subaltern, and was received by musketry fire which drove them back with the loss of their leader, who fell mortally wounded into the hands of the picquet, and of more killed and wounded than the enemy could carry off. Two 9-pounder guns, brought up from camp under the escort of a subaltern and 25 men from the right brigade to support the picquet, compelled an abandonment of the cover in front which the enemy had used as a *point d'appui*. The left front and flank were threatened throughout the day, and after dark the enemy's infantry assembled in great strength in front of picquet No. 5, reinforced to 200 men, commanded by a major, who allowed the rebels to approach within 80 yards, and

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then opened fire with three guns, and his infantry. As they withdrew with loss, he followed them up with shells from a mortar. Attempts by cavalry against the left rear had been watched and checked throughout the day by four horse artillery guns. The division had a bombardier killed and eight men wounded.

The successful repulse of this attack and the prospect of the arrival of the Commander-in-Chief now moving towards Lucknow relieved the General of much anxiety; but still he felt it necessary to warn headquarters that, owing to the enormous numbers of the enemy and the extent of his position, he was obliged to keep his men in readiness, and as there was a perceptible change in the temperature, the hospitals would begin to fill under so much exposure. Moreover that unless reinforced ere compelled to detach another convoy, he would have hard work in repelling the incessant attacks of the increasing hosts of the enemy, headed by the many territorial chiefs reported to be in the city or immediate vicinity. It must not be supposed that the General allowed his anxiety to be shared by his troops. Seldom has duty of any sort been performed with greater confidence and cheerfulness by all ranks. In the intervals between the attacks, as much as possible was done to relieve the monotony of camp life. Officers off duty were allowed to go for short distances shooting, and to get up races. During Christmas week the usual sports were organized for the men.

About this time the Intelligence Department received news that a grand assault was being planned, and that a particular day, the opening one of a festival, had been fixed for the purpose. The assault, however, did not come off, much to the disappointment of the General, who having been rejoined by the convoy escort and reinforced by some cavalry, had hoped to inflict a severe defeat on the rebels, and to capture some of their guns. The spies reported a day or two afterwards that the enemy's troops and guns had taken up positions during the night; that in the morning their generals had ensconced themselves at a respectable distance in the rear, that the men were accoutred, and all were apparently in readiness. They did not advance, however, and the rebel leaders sent for the chief officers of divisions, to inquire the reason. They replied that they would attack, since it was better to die fighting than to be hanged, but they must have their pay first.

From this period till the 15th February the rebels evinced a nervous restlessness, which betrayed itself in constant assemblies of cavalry and infantry, and by demonstrations of attack, which were instantly stopped by a few rounds from the guns at the supports. About this time the concentration of troops and material for the projected attack on the city had commenced, and on the Cawnpore Road stood a succession of detachments at intervals of an easy day's march, somewhat resembling the system of stages by which a

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German field army maintains communication with its base. The continued movement of troops and stores was known to the enemy, and caused the activity on his part which, though occasioning few casualties to the British division, constantly necessitated the turning out and remaining under arms.

On the 13th February the news from the *Court Journal*, as the epitome of daily intelligence was styled in the British camp, was to the effect that an attack on all points of the position was planned for the 15th. It seemed probable that under the mingled taunts, promises, and threats of the so-called "Queen Mother" the rebels might be induced to make one desperate last attempt, and that if, as was expected, she should come out, it was possible that the whole force then collected in Lucknow, regular and irregular, might be inspirited to join the attack.

The General, with a view of being able to inflict a heavy blow, requested when passing on this intelligence to army headquarters, now returned to Cawnpore, that the order for a battalion to be withdrawn from his command in exchange for a raw one of native sappers might be countermanded. The request was complied with, but the next day it was reported from the city that the expected movement of the rebels had been abandoned, and a message was sent to the bridge post for the battalion to resume its march on Cawnpore.

Notwithstanding, however, the failure of the rebel Court to induce their troops to come out in mass, a demonstration took place on the day in question, concealed to some extent by a violent dust-storm, round the left of the British position against the high road, along which a convoy was at the time marching. The horse artillery escorted as usual by cavalry, and dashing well out, supported also by the nearest battalion of the left brigade, sufficed to disperse the enemy's cavalry and infantry, wounding their chief, a Mussulman dignitary, who rode in a litter. The division had only one man wounded.

Next day, the 16th February, the rebels, while they threatened, as on former occasions, the left flank with cavalry and infantry, filled their trenches and the groves in rear of these with the latter arm, but although they began their demonstration in the morning, they did not muster resolution enough for the attack till about 5.30 p.m. when they suddenly issued in clouds of skirmishers against the guns of the centre and left, and in large bodies advanced against the village where the picquet had been reinforced to a strength of 200 men under a lieutenant-colonel. This picquet had three men wounded before it repulsed the enemy. For a couple of hours after dark a heavy musketry fire was kept up against the north and east faces of the Alumbagh without occasioning any loss to the defenders, who aimed grape and shrapnel against the line indicated by the flashes of the muskets.

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On the 17th, while a partial advance against the right and left picquets was repulsed by artillery fire, some 2,000 infantry, sent by the enemy towards the right rear, withdrew towards the city on the appearance from camp of a couple of squadrons and two guns. The information received at this time was to the effect that the rebels proposed continuing these attacks daily and from all quarters. Consequently the picquets had to be maintained at abnormal strength, and the troops were harassed by being constantly turned out.

In échelon behind the line of two picquets, both of which were armed with guns, was established a fresh battery guarded by an escort. The Jellalabad half-way picquet was furnished from camp, strength 2 subalterns and 50 infantry. The Alumbagh detachment was increased to 275 rank and file. The proportion of men at the outposts to those in camp was, however, now so great that the reliefs of many of the picquets could only be effected every three days, sometimes only weekly. The General again remonstrated against his troops having under these circumstances to furnish the convoy escorts half-way to the bridge posts in rear.

On the morning of the 21st February, while the strength of the division, particularly in cavalry, was reduced by such an escort, a simultaneous movement took place threatening both flanks, as well as the whole front of the position, the points actually attacked being the north-east angle of the Alumbagh and the fort of Jellalabad with the half-way picquet. The troops holding these posts were reinforced, while a body of about 250 cavalry with two guns was sent to the rear of the fort, and coming suddenly on about 2,000 of the rebel cavalry drove them back on their infantry some 5,000 strong, which latter after advancing to within range of grape, retired with loss. The left flank was threatened by 8,000 to 10,000 infantry with 500 cavalry, against which force were sent with the usual result, four horse artillery guns escorted by about 120 troopers, and supported by the available strength of the left brigade.

The division had 9 men wounded, while the reports from the city gave the loss of the enemy as 60 killed and 200 wounded in front of Alumbagh, with some 80 or 90 casualties near Jellalabad.

A few days before the 25th, the first instalment of troops composing the force which the Commander-in-Chief was concentrating for the capture of Lucknow arrived within the lines of this division, and were temporarily at the disposal of the General. These consisted of a battalion which had for some days past been distributed on the line of communication with Cawnpore, of several squadrons, and of a troop of horse artillery. By this time a large quantity of combustible stores had been collected in the fort of Jellalabad. An attack was expected on the 29th, but did not come off.

On the 2nd March, the advance of the Commander-in-Chief began with a second division of infantry, a brigade of cavalry and four

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batteries, from the Cawnpore Road, by a line leading east from Jellalabad, into a position of which the right rested on the river Gúmti behind Dilkoosha, followed on the next two days by the closing up of the siege train and of a third division of infantry causing the withdrawal of the bulk of the rebel forces to the extensive defences which they had constructed along and in advance of the eastern end of the canal, and thus removed the pressure on the front of the 1st Division, which had stood for three months unsupported. It had been for some time previously made movable by provision of carriage for baggage and tents, and it was now gradually reduced by the withdrawal from its organization of the greater portion of the cavalry, of which part was sent to preserve communication between Jellalabad and the Commander-in-Chief's camp, while the remainder made up from fresh arrivals to the strength of a brigade was extended westward to watch the exits from the city in that direction, and by the successive dispatch of battalions and guns to reinforce the main attack from the east. The General was summoned on the 5th to conduct a turning movement on the north bank of the Gúmti. On the 12th there remained in his former camp but one brigade of infantry, and on the 16th only two battalions with the horse artillery.

Meanwhile the advance, from the eastward, of the army by a movement in échelon from the right, as the entrenchments and palaces held by the rebels were successively turned or stormed, had the effect of causing the old pressure on the Alumbagh position to be renewed to a serious extent. On the 15th most of the army was established on a line fronting to the south-west, and, therefore, towards the Alumbagh, from which post the left was distant 3 miles as the crow flies. The space between the Commander-in-Chief's inner flank and the canal was filled by a body of Nepaulese troops, which had arrived on the 12th as allies against the Oudh Pretender, and had come into line with a force of about 9,000 infantry and 24 field guns drawn by men. On the 15th one of their detachments after a short fight took possession of the Yellow House, a building midway between Alumbagh and the canal, but withdrew from it after dark without giving notice to the British outposts, who were in the sequel somewhat embarrassed by uncertainty as to whether that point was held by friend or foe.

During the whole time Sir James Outram held the position at Alumbagh, from the 22nd November, 1857, to the 17th March, 1858, Capt. Olpherts (afterwards General Sir William Olpherts, V.C., G.C.B.) commanded a battery and was present at all the engagements at this time. The previous services of Sir William Olpherts at Benares, and at the Relief of Lucknow by Havelock are well known.

On the 16th, the Commander-in-Chief's right led by the former General of the 1st Division gained another mile to the westward.

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"And in short," as was the language of His Excellency's dispatch, "the city was ours." With like brevity it is stated that on the 16th, for the last time, the enemy showed in some strength before Alumbagh; that the Goorkha leader was requested to move to his left up the canal and take the position; that His Highness executed this very well, and that he seized the positions, one after another, with little loss to himself, the enemy's guns falling into his hands. Some details, however, of this, the last brush that took place on the front of the position, may not be uninteresting. They are produced in nearly the identical words of the field officer who commanded in the Alumbagh enclosure.

Between 8 and 9 a.m. he observed from the roof of the palace a large body of cavalry coming out of the city, while infantry manned the batteries and trenches along the front of the position. An orderly was immediately dispatched to the brigadier in camp, who in consequence of this, and information subsequently received, telegraphed in the course of the day to the Chief of the Staff with Army Headquarters :—"The enemy are coming on in immense force, both cavalry and infantry, with field guns on my left front and towards the dense wood close to Alumbagh. Nothing seen of the Goorkhas. I have drawn up my infantry and field guns, and my batteries have opened upon them. I have only 140 cavalry here." The rebels' movement continued to be observed from the Alumbagh roof, their cavalry in most regular order proceeding along the rear of their batteries. A few shots were fired from the heavy guns of the outpost, but the range of the nearest point of their line of march was upwards of 2,000 yards. They were accompanied by three horse and two bullock guns, and their numbers were estimated at not less than 3,000 sabres. The cavalry continued its march until it had passed the left flank of the position some distance, and then, developing upon the plain in order of battle, was seen to charge down in the direction of the village held by picquet No. 5. During this time the batteries and trenches in front of Alumbagh had become crowded with infantry. About 1,000 men with colours came out and took position in spite of the fire of the British rifles, about 400 yards in front of the Mosque picquet, and kept up a warm matchlock fire upon it and the enclosure. Some discharges of grape from all the available guns caused them severe loss as appeared from the bodies found next morning. The enemy's trenches had on the previous occasion been seen by the field officer to be crowded, and he estimated the strength of their infantry in front of him to be not less than 5,000. This attack commenced simultaneously with the cavalry charge, and was not abandoned till about noon. As heretofore the more open left flank was freed by the dash and fire of the horse battery, supported by the available infantry from camp.

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Thus the important duty of covering the Cawnpore Road which still formed the line of communication for the British Army Corps until the course of operations in the city had brought the left forward to the westward of Alumbagh, was successfully performed up to the last by the remnants of the 1st Division.

After the evacuation of Lucknow, Lieut. McLeod Innes, who had greatly distinguished himself during the Defence, was posted to General Frank's column during his march through Oudh and gained the V.C. at the Battle of Sultanpore. He afterwards joined the army before Lucknow, and was severely wounded on the day of joining. The amount of labour expended on the works by the rebels was enormous. Streets a mile long had almost every house loopholed, and guns pointed from many of them. The bridge across the Gúmti had also been ruined.

On the night of March 4th two bridges of casks were completed across the Gúmti, a very troublesome and difficult operation. General Outram with his division, consisting of the Queen's Bays, 9th Lancers, and the Highland Brigade and other troops, crossed the river on the 6th and met with little opposition. The remainder of the army being posted at Dilkoosha about 1,000 yards in rear of La Martinière.

Brigadier Franks joined the army about this time with Jung Bahadur and 4,000 Goorkhas. This manœuvre of crossing the river was a splendid success, and completely baffled the enemy. The rebels' earthworks on the south side of the river were enfiladed by the guns of Outram's Division on the other side of the river.

On the 7th the Sepoys made a sharp attack on General Outram, but were repulsed without difficulty, and retired within their lines, leaving him free to push forward.

While referring to La Martinière, special mention should be made of the excellent service rendered by the boys of the Martinière College, whose gallantry in the defence of the post assigned them in the Residency has rarely been surpassed, and forms a bright page in the history of that long siege. In the grounds of the Bailey Guard there may still be seen a masonry pillar with a marble slab inserted, on which are inscribed the words Martinière Post. The three companies formed from the students of the College wore as a badge on their accoutrements a turreted castle with the words "Defence of Lucknow," the same honour as was awarded to the 16th, the Lucknow Regiment of Bengal Infantry, which was formed in 1858 from the loyal remnants of mutinous native regiments who fought throughout the siege by the side of the British, and held firmly to the post called the Bailey Guard.

On the 9th March the Martinière was assaulted and captured with very little loss. The Engineer officers who accompanied the assaulting column were Lieuts. A. M. Lang, J. G. Forbes, E. T. Thackeray,

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Swetenham, and H. J. Nuthall. Each officer was in command of a detachment of sappers, and formed up in rear of the Dilkoosha. At the signal the troops raced across the space between the Martinière and the Dilkoosha. After capturing La Martinière the column pushed on to a village on the right close to the enemy's first line of entrenchments. Here, an officer of the 1st Bengal Fusiliers, Lieut. Butler, was seen standing alone on the bastion waving his hand. He had swam across the river, and had climbed the parapet remaining there until the work was occupied by our troops. For his conduct on this occasion, Butler was awarded the Victoria Cross.

On the evening of the 9th, Sir Colin Campbell, who had secured La Martinière in the morning, was able to advance on the canal line which had been enfiladed and taken in reverse by the batteries already established by General Outram. He secured the line without loss. The forward movement was now continued, the houses and palaces being used as approaches. In this way the second line was turned to the left. Batteries were then thrown up to break a large block of palaces called the Begum Kotí on the right which were then stormed and carried.

From thenceforward the Chief Engineer, Brig.-General Napier, pushed his approaches with the greatest judgment through the enclosures by the aid of the sappers and heavy guns, the troops immediately occupying the grounds, and the mortars being moved from one position to another as ground was won on which they could be placed. (Sir Colin Campbell's dispatch). At length the third line was turned, and the Kaiser Bagh entered. Supports were quickly thrown in, and the Mess House, the Tara Kotí, the Motee Mahal, the Engine House, and the Chattar Munzil, were rapidly occupied by the troops, while the Engineers devoted their attention to securing their positions towards the south and west. Owing to being taken in flank by the fire from the guns with General Outram's Division, and to our advance, the enemy had not only evacuated the Martinière, but their first line of entrenchments as well. So the first line up to Banks's house was captured without great loss. While advancing from the Martinière to the village rather a heavy fire was met with from the village, and here the Highlanders lost a few men. The Sepoys could be seen running along the ramparts in hundreds.

On the 11th, the Artillery and Naval Brigade, under Sir William Peel, had battered and breached the Begum Kotí with three 68-pounders. This was then assaulted and carried by our troops, the enemy losing about 500 men. Lieut. McBean, Adjutant of the 93rd Highlanders, here gained the V.C., and greatly distinguished himself, killing 11 of the enemy with his own hand in the main breach.

It was after this assault that Hodson, of Hodson's Horse, lost his life. He was the finest leader of irregular cavalry in India, and

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his loss was greatly mourned by everyone in the force. He had arrived at Banks's house just as the party going to attack the Begum Palace had started, and accompanied them. Previous to this he had remarked in a laughing manner to his friend Brigadier Napier (afterwards Lord Napier of Magdala) "I am come to take care of you, you have no business to go to work without me to look after you." The place had been taken before he was wounded. When the soldiers were searching for concealed Sepoys in the court-yard and buildings adjoining, he said to his orderly "I wonder if any are in there." He turned the angle of the passage and looked into a dark room which was full of Sepoys; a shot was fired from inside. He staggered back some paces and then fell. A party of Highlanders hearing who had been hit, rushed into the room and bayoneted every man there. Hodson was shot through the right side of the chest, the ball entering in front and going out behind. He was taken in a dooly to Banks's house, where his wound was dressed. At daylight the following morning he was much better, his hands being warm and his pulse good. The medical officer hoped that if the bleeding, which had ceased, did not return he might recover. At 10 a.m., however, bleeding came on again profusely, and he rapidly became worse. He sent for General Napier, to whom he gave directions about his property, and sent messages to his wife. After this he rapidly sank, though he remained sensible, and was able to speak until he became too weak, and at 25 minutes past 1 he died. He was buried that evening, the Commander-in-Chief and his staff being present. Thus, on the 12th March, 1858, in his 37th year, closed the earthly career of this brave and talented officer. One of those best qualified to judge declared that Hodson with his regiment would have been worth a division, had he been spared to take part in the subsequent operations in Oudh. His particular qualifications for Asiatic warfare would have found an appropriate field for their display. Sir Colin Campbell, in a letter of condolence to his widow, dated March 13th, thus expressed himself:—"I followed your noble husband to the grave myself, in order to mark in the most public manner my regret and esteem for the most brilliant soldier under my command, and one whom I am proud to call my friend."

In the evening a battery was constructed by the sappers at the side of the Begum Kotí. The place presented an extraordinary sight with its palace, gardens, and lamps with enormous mirrors and chandeliers, dead Highlanders and Sepoys lying in all directions. The Engine House was captured by the 20th Regiment. The Sepoys seemed paralyzed by the suddenness of the attack, and had not time to escape. They were piled in heaps among the machinery. A portion of the room had caught fire, and this added to the horrors of the scene. At night a great part of the city appeared to be in

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flames. Fires were seen in all directions, while the shells from our batteries continued to pour into the city. The enemy was badly supplied with shells. This was the last day of regular fighting, but the rebels hung about the native city for a few days. The losses on our side during the operations were about 25 officers killed and 50 wounded, and 800 men killed and wounded.

The force under General Outram which had been advanced on the other side of the Gumtí, now recrossed on a bridge of casks, and pushed forwards to capture the Residency. This was the last move and the enemy abandoned the defences. Still there were detached forts held by desperate bands of natives, and it was not till the 21st that all fighting ceased.

During the operations a most unfortunate accident happened. At the Jumma Musjid nine cartloads of powder were found in a courtyard which the General directed to be destroyed. As there was a well on the spot it was considered that the best method of destroying the powder, which was in tin cases, would be to throw them down into the water. A line of men was formed and the cases passed from hand to hand as quickly as possible. By some fatality one of the cases exploded in falling. A flame of fire flashed up, and ignited case after case along the line until the carts were reached when they also exploded. Capt. Clarke, R.E., and Lieut. Brownlow, R.E., who were superintending the operations, received such injuries that they both died during the night. With one exception every man forming the party, to the number of 22, were killed. Strangely enough the only man to escape was the man who was throwing the cases down the well. He was rendered senseless, but eventually recovered.

The duties of the Engineer officers during the Capture of Lucknow, although arduous, were not of such a dangerous nature as at Delhi, and the operations lasted only for fifteen days. The Kaiser Bagh at the time of its capture was a splendid mass of buildings with large gardens and gilt domes and statues.

The amount of loot obtained by some of the regiments was considerable. Diamond necklaces, shawls, and swords of great value were sometimes obtained by private soldiers, and sold for a few rupees. For two or three days after the capture of the town the troops were employed in extinguishing fires and destroying loose gunpowder, an immense quantity of which was found in the positions occupied by the rebels.

(*To be continued*).

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THE IRISH ENGINEERS.

MAJOR J. J. CROOKS, of 35, Brighton Road, Rathgar, Dublin, writes as follows :—

"When working at *A History of the Royal Irish Regiment of Artillery*, 1755—1801, I came across a short article in *The Journal of the Royal Society of Antiquaries of Ireland*, for December, 1910, by Lieut. W. P. Pakenham-Walsh, R.E., containing 'Roll of the Corps of Royal Engineers of Ireland, 1251—1801.'

"Since the publication of the History above referred to, I am indebted to the Library of the Art and Industrial Division of the National Museum of Ireland for the accompanying copy of the King's Warrant for Discontinuing upon the Ordnance Establishment of Ireland from the 1st October, 1789, the Corps of Engineers, and for placing upon the said Establishment a Company of Royal Engineers.

"Hoping that the information contained in the Warrant may be of some interest to readers of the *R.E. Journal*."

The Warrant alluded to is as follows :—

Regulations in the Ordnance Establishment in Ireland to Commence from the 1st of October, 1789.

George R.

Right Trusty and Right Wellbeloved Cousin and Counsellor We Greet you well.

Whereas in your Letter to the Commissioners of Our Treasury bearing date the 3rd day of February 1790 you represented that Our Right Trusty and Wellbeloved Counsellor William Windham Grenville one of our Principal Secretary's of State having in his Letter of the 8th October last 1789 to the Marquis of Buckingham late Lieutenant General of Our Kingdom of Ireland set forth that he had taken the earliest opportunity of laying before us our said Lieutenant General's Letter Military of the 1st of October aforesaid representing the situation of the Corps of Engineers in that Kingdom and of the several Officers of which it was composed and proposing in consequence of his different Communications with the Commander in Chief upon the subject the means of putting that essential part of the National defence upon an Establishment best adapted to the

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Circumstances of the Country and to our service and that We after taking the same into full consideration were of opinion with our said Lieutenant General, that from that Corps as at present constituted very little assistance could be derived he was commanded to signify our pleasure that in the room of the present Corps of Engineers, a Company of Royal Engineers should be substituted to consist of the following Officers to enjoy the several Ranks hereinafter specified with the same appointments as to pay and allowances as is established by our Regulations for the Corps of Engineers serving in Great Britain. "That is to say,"

Colonel Thomas Pigott Director of Engineers with his Brevet Rank attached as at present to his Commission.

Colonel Charles Vallancey, Lieutenant Colonel

Lieutenant Colonel Charles Tarrant, Major

Major James Ferrier, Captain

Lieutenant John Browne of the 27th Regiment, Captain Lieutenant

Alexander Taylor, First Lieutenant

And one other First Lieutenant

And that with respect to Captain Forth who from the Wounds he had received was incapable of service and was not included in the above succession, It was Our pleasure agreeably to our said Lieutenant Generals Proposal that he should receive his pay as Captain charged upon the Contingencies of the Ordnance and the Commissions for the before-mentioned Gentlemen having been accordingly received there signed by us and dated the 1st day of October last 1789 in order to carry our pleasure before mentioned into Execution accordingly you desired our said Commission would move us for our Royal Letter for discontinuing upon the Ordnance Establishment of our said Kingdom from the 1st day of October last 1789 inclusive the Corps of Engineers with their pay as it present stands thereon, "that is to say,"

		per Diem	*per Annum*
1 Chief Engineer	at	1 2 2¼	405 0 0
1 Director	at	0 15 0	273 15 0
2 Engineers in ordinary	at	0 10 0	365 0 0
			£1043 15 0

amounting in the whole to the annual sum of one Thousand and Forty Three pounds fifteen shillings.

The Sub Engineer and practitioner Engineer having some time since been discontinued on the said Establishment in consequence of the Death or other avoidance of the Officers who held these Commissions in pursuance of our Letter bearing date the 15th day of May 1766 and for placing upon the said Ordnance Establishment a Company of Royal Engineers to consist of the following Officers

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and at the several allowances of pay hereinafter mentioned "that is to say,"

	per Diem			*per Annum*		
1 Director of our Company of Royal Engineers ..... at	1	2	2¼	405	0	0
1 Lieutenant Colonel of ditto Company....	0	15	0	273	15	0
1 Major of ditto Company	0	15	0	273	15	0
1 Captain	0	10	0	182	10	0
1 Captain Lieutenant	0	4	8	85	3	4
2 First Lieutenants each	0	4	8	170	6	8
				£1390	10	0

amounting in the whole to the annual Sum of £1390 10 0, the same to commence from the 1st day of October last 1789 inclusive to continue during our pleasure and to be paid and payable in such and the like manner as the Corps of Engineers heretofore placed upon our Ordnance Establishment of that Kingdom was payable and paid; but it being intended that the aforesaid change should not affect Colonel Thomas Pigott who now holds the office of Chief Engineer in that Kingdom by Letters Patent passed under the Great Seal thereof in Pursuance of Our Royal Letter bearing date the 26th of April 1776 you requested that a Clause might be inserted in our said Letter directing that the aforesaid change of the Establishment of Engineers should not take place with respect to the Office of Chief Engineer so long as Colonel Pigott the present Chief Engineer should hold the said Office, but that upon his avoidance thereof the said Office of Chief Engineer should cease and determine and the Office of Director of Engineers as appointed by the aforesaid change of the Establishment with the pay and allowances annexed thereto should commence. Also that a Clause might be inserted in our said Letter for placing upon the Ordnance Contingencies in that our said Kingdom an Allowance of 10/- a Day for Captain Arthur Forth late Engineer in Ordinary in that Kingdom the same to commence from the 1st day of October last 1789 inclusive to continue during our pleasure and to be paid and payable as the other Contingent Expences of the Ordnance are payable and paid, And you further represented that by the 10 Articles of our Instructions to the Treasurer to the Ordnance in that Kingdom it was directed that at Lady Day every year or within 14 days next after he was to deliver or cause to be delivered at the Board of our Office of Ordnance an account, not only of all Monies by him received out of our Treasury within the year ending 31st of December preceding attested by Certificates from our Treasury but also of all other Monies which have come to his Hands within the said Time upon the sale of any sort of decayed Stores or otherwise of our Service as the Charge of his account, and it having been represented to you by the Board of Ordnance in that

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our said Kingdom that it would be of great convenience in the making up of their Accounts of Receipts and Expenditures if they were permitted to conclude their year upon the 31st day of March in every year being the period at which the year of the Military Establishment of our said Kingdom is concluded you therefore desired that a further Clause be inserted in our said Letter authorizing you notwithstanding the said Instructions to issue the necessary Orders to the Board of Ordnance to direct their Treasurer to deliver or cause to be delivered at the Board of our Office of Ordnance an account not only of all Monies by him received out of our said Treasury etc. within the year ending the 31st day of December last but also within the three ensuing months up to the 31st day of March next 1790, and that in future the accounts so directed to be made up and delivered in the said 10th Article of Instructions be made up for the period within the year ending on every 31st day of March or such other period as the Government of that Kingdom shall from time to time direct the said Accounts to be delivered as directed by the 10th Article of Instructions within three months of the period to which they shall be made up. Now We being graciously pleased to consent thereto, Our Will and pleasure is and We do hereby direct authorize and require you to give the necessary Orders and directions for discontinuing upon the Ordnance Establishment of that our said Kingdom of Ireland from the 1st day of October last 1789 inclusive the Corps of Engineers with their pay as it present stands thereon, "that is to say,"

	per Day			*per Annum*		
1 Chief Engineer at	1	2	2¼	405	0	0
1 Director at	0	15	0	273	15	0
2 Engineers in ordinary at	0	10	0	365	0	0
				£1043	15	0

amounting in the whole to the annual Sum of One Thousand and Fortythree Pounds fifteen Shillings, and for placing upon the said Ordnance Establishments a Company of Royal Engineers to consist of the following Officers and at the several Allowances of pay hereinafter mentioned "that is to say,"

	per Day			*per Annum*		
One Director of our Company of Royal Engineers .....at	1	2	2¼	405	0	0
One Lieutenant Colonel of do Company at	0	15	0	273	15	0
One Major of do Company .....at	0	15	0	273	15	0
One Captain .....at	0	10	0	182	10	0
One Captain Lieutenant .....at	0	4	8	85	3	4
Two First Lieutenants each .....at	0	4	8	170	6	8
				£1390	10	0

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amounting in the whole to the annual Sum of One Thousand three Hundred and ninety Pounds Ten Shillings the same to commence from the 1st day of October last 1789 inclusive to continue during our pleasure and to be paid and payable in such and the like manner as the Corps of Engineers heretofore placed upon our Ordnance Establishment of our said Kingdom was payable and paid and you are to give Directions that the aforesaid Change of the Establishment of Engineers shall not take place with respect to the office of Chief Engineer so long as Colonel Pigott the present Chief Engineer shall hold the said Office, But that upon his avoidance thereof of the said Office of Chief Engineer shall cease and Determine and the Office of Director of Engineers as appointed by the aforesaid Change of the Establishment with the pay and allowances annexed thereto shall commence and you are also to give directions for placing upon the Ordnance Contingencies of that our said Kingdom an allowance of 10/- a Day for Captain Arthur Forth late Engineer in Ordinary in that Kingdom the same to commence from the 1st day of October last 1789 inclusive to continue during our pleasure and to be paid and payable as the other Contingent Expences of the Ordnance are payable and paid, and We do hereby direct authorize and require you notwithstanding the 10th Article of Our Instructions to the Treasurer of the Ordnance in our said Kingdom to issue the necessary orders to the Board of Ordnance to direct their Treasurer to deliver or cause to be delivered at the Board of our said Office of Ordnance an account not only of all Monies by him received out of Our Treasury etc. within the year ending the 31st day of December last, but also within the three ensuing months up to the 31st day of March next 1790 and that in future the accounts so directed be made up and delivered in the said 10th Article of Instructions be made up for the period within the year ending on every 31st day of March or such other period as the Government of our said Kingdom shall from time to time direct the said accounts to be delivered as directed by the said 10th Article of Instructions within three months of the period to which they shall be made up, and for so doing this shall be as well to you as to our Lieutenant Deputy Justices, or other Chief Governor or Governor of that our Kingdom for the time being and all others who shall or may be herein concerned a sufficient Warrant and so We bid you heartily farewell.

Given at Our Court at St. James's this 26th day of March 1790. In the Thirtieth year of Our Reign. By His Majesty's Command

W. PITT, BAYHAM, APILEY.

Entered at the Signet Office this 7th day of April 1790

J. TIREL MAIN

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REVIEW.

STRUCTURAL STEEL. R. A. SKELTON & CO.'S HANDBOOK No. 16.

(R. A. Skelton & Co., Moorgate Station Chambers, London, E.C. Price 10s. net).

THIS handbook has been compiled with a view to being of use to all interested in structural steelwork, and has a very wide scope. As the publishers remark in their introduction, it is not intended to enable the reader who has no engineering training to set about the design of a steel structure, but to furnish guidance to engineers well acquainted with elementary principles, but rusty in the application of them, and time-saving tables and diagrams for the benefit of experts.

The book is divided into two parts, the first part containing lists of sections and materials, together with the various drawings and tables relating to them; and the second part consisting partly of notes and data on the design of structural steelwork, and partly of general data.

The first part commences with a catalogue of rolled steel sections, giving the dimensions and weights of British, metric, and American joists, channels, tees, etc. The next chapters tabulate the properties of the various sections, comprising dimensions, weight, area, moments of inertia, section moduli, radii of gyration, resistance moments, maximum distributed loads, and safe loads in tons for various lengths and loading. The information is most complete, the chapter dealing, for instance, with British standard joists giving special properties, full size part section drawings, and standard girder connections. The succeeding chapters deal with steel plates and sheets; rivets and bolts, giving shear stresses, bearing values, spacing, etc.; wire and miscellaneous fittings, troughing, etc. Plated girders and stanchions are next dealt with; and the first part concludes with most comprehensive chapters on girders and stanchions. In addition to the tables many nomograms are given: *i.e.* diagrams drawn to scale from which a desired value may be read off by the use of a straight edge. Explanations abound; the chapter on girders, for instance, contains eight pages of diagrams and formulæ for shear, bending moment, and deflection in all conditions of support or fixing, and loading.

The second part of the book comprises chapters under the following headings:—Concrete and Reinforced Concrete, giving general principles and formulæ: Roofs, including a diagram giving wind loads on roofs: Foundations: Weights of Various Materials: Extracts from the L.C.C. (G.P.) Act, 1909 (Amendment of London Building Acts): Notes on

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Steel Manufacture: Tests, etc.: Mathematical Tables, including four figure logs and anti-logs, natural and log functions of angles, squares, mathematical properties of various sections, etc.: Weights and Measures, including Conversion Tables: and a complete index.

The book is well arranged and convenient for reference. It is thumb indexed throughout, thus enabling the reader to turn at once to the required chapter, while at the commencement of each chapter is usually a summary of the chapter, giving the page on which the desired subject matter is to be found.

Space does not permit of giving more than the foregoing brief summary of this handbook, which contains a mine of useful information, and should prove invaluable to the R.E. officer, who is liable to be suddenly called upon to put into practice the principles learned by him perhaps several years past, and who may feel for the moment somewhat at a loss as to how to set about his task.

J.D.B.

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REVIEW OF THE OPERATIONS OF THE BELGIAN ARMY, 31st JULY TO 31st DECEMBER, 1914. (BY THE GENERAL STAFF OF THE BELGIAN ARMY).

MAJOR W. A. J. O'MEARA, C.M.G., *p.s.c.*, LATE R.E.
(Barrister-at-Law of the Inner Temple).

THE valiant deeds performed by the gallant little Belgian Army in defence of hearth and home and in the attempt to obtain respect for the status of a neutral imposed upon its country by treaty stipulations will live in the memory of man for all time and cannot fail to evoke the highest admiration so long as a spark of the spirit of chivalry exists in this world. It is yet too early in the day for a critical history to be written of the part played by the troops of any of the combatant nations, even in relation to the events a year ago, but a bare recital of the movements carried out in the first days of the War by the troops taking part in the present titanic struggle can, however, well be placed on record at this date; such a record concerning the doings of King Albert's troops during the first five months of the War, 31st July to 31st December, 1914, has recently been published, in the form of a report, by the General Staff of the Belgian Army, under the title "L'Action de l'Armée Belge pour la Défense du Pays et le Respect de sa Neutralité."* This report consists of nine exceedingly short chapters, accompanied by sketch maps; the latter, of which there are 11, are bound into the volume in a very convenient manner so that the reader can have each map in view above the letterpress relating to the events affecting the region depicted therein. The map of Antwerp (No. 8) is reproduced by the kind permission of Messrs. W. H. & L. Collingridge, City Press, 148 & 149, Aldersgate Street, E.C. The Book should command an extensive circulation.

Preliminary Details.—The first chapter deals with the preliminary details connected with the Belgian preparations for war. It is stated that, war having become imminent, three classes of the Militia were recalled to the colours so as to bring the establishment of the Army to the footing known as "paix renforcée." This step was necessary because Belgium being a country small in extent its whole territory constituted a frontier zone and the entire Belgian Army was but a "corps de couverture."

When war broke out a commencement had only just been made with the reorganization of the Belgian Army, recently

* W. H. & L. Collingridge, City Press, 148 & 149, Aldersgate Street, E.C.

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authorized by the Legislature, which provided for an increase of the war establishment up to a total of 350,000 men. However, as this establishment could not be raised to the total named till 1918, the Ministry had approved a scheme which made provision for the mobilization and concentration of the Army (which was totally unprovided with heavy artillery), during the interreguum period, in accordance with the plans made for the defence of Belgium.

Events marched rapidly in July, 1914, and on the 31st *idem* the then exceptional gravity of the European situation rendered it necessary to mobilize the Belgian Army at once; the proclamation ordering mobilization was consequently issued at 7 p.m. on the date last mentioned.

In peace time, the Belgian Army occupied quarters as follows:—

1st Division (Headquarters Ghent): Ghent, Bruges, Ostend and Ypres.

2nd Division (Headquarters Antwerp): Antwerp.

3rd Division (Headquarters Liège): Liege, Hasselt and Verviers.

4th Division (Headquarters Namur): Namur and Charleroi.

5th Division (Headquarters Mons): Mons, Tournai and Ath.

6th Division (Headquarters Brussels): Brussels.

The Cavalry Division was stationed in and about Brussels.

The centres for the concentration of the Belgian Army had been chosen with a view to the fulfilment of the obligations imposed on Belgium in 1839 to remain a neutral state; thus, the 1st Division (or Flanders Division) was in observation to meet any hostile intrusion on the part of British troops; the 2nd Division (or Liège Division) was in position to bar the advance of German troops into Belgium; whilst the 4th and 5th Infantry Divisions were drawn up to oppose a French invasion, the 4th Division being intended to repel an attack on Namur and the 5th Division a French advance from the line Lille-Maubeuge.

The task assigned to each of the four divisions last named was that of holding an invader attempting to penetrate Belgium by the sector of defence for which the division was responsible, until such time as the remaining five divisions could be brought into the territory immediately threatened by hostile forces.

The defence of the fortresses of Antwerp, Liège, and Namur was entrusted to the seven oldest classes of Militia; this left the eight classes of the Militia most recently trained for service with the field army.

The measures adopted in Belgium up to date had, as stated by the Belgian Minister of Affairs in a communication to the diplomatic representatives of Belgium at foreign courts, for their sole object the purpose "of putting Belgium in a position to fulfill her international obligations: they were in no way inspired by a spirit of defiance towards any single power."

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At 7 p.m. on 2nd August, whilst the mobilization of the Belgian Army was in progress, the German Ambassador at Brussels handed the now famous Note demanding an unopposed passage through Belgium for German troops, then ready to march to the northern frontier of France, a reply to this demand was required by the midnight following.

Two passages in this Note were of significance from a military point of view :—

(i.). The German Government alleged that it had received absolutely reliable intelligence that French troops were about to advance by Givet and Namur on to the line of the Meuse.

(ii.). It was further alleged that measures necessary for the safety of the German Empire made it imperative for the Imperial troops to march through Belgian territory, and a demand was made that Belgium should offer no resistance to these troops, notably at the fortified places on the Meuse, by the destruction of roads, railways, tunnels, or other engineering structures.

The Belgian Government did not cease its defence preparations on the receipt of this Note ; on the other hand, orders were issued to the Belgian units on the frontier to open fire on any foreign troops attempting to violate the neutrality of the State. The Belgian Government had at the same time replied to the German Note stating definitely that " it would repel by every means in its power, any attempt whatsoever made by Germany on the sovereign rights of Belgium " ; and further that " if contrary to all expectations, a violation of the neutrality of Belgium should by chance be effected by France, Belgium would fulfill all international obligations imposed upon her and her army would offer the most strenuous opposition to this invader." At the same time an offer of military assistance from the French Ambassador in Brussels was declined, owing to the fact that no general appeal had up to that time been made by Belgium to the guaranteeing Powers.

During the night of 3rd—4th August, intelligence was received which left no doubt whatever that German troops were about to force a way for themselves through Belgian territory. In consequence, the Belgian General Staff ordered the destruction of bridges on the lines of advance likely to be used by the German Army, and the Military Governors of the various districts were informed that under the circumstances then existing the entry of French troops into Belgium was no longer to be looked upon as a violation of neutral territory.

The progress of events imposed on the 3rd (Belgian) Division the duty of bearing the brunt of the first blows about to be struck against the liberty of the Belgian nation; steps were immediately taken to

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move forward the 1st (Belgian) Division from Ghent to Tirlemont; the 2nd (Belgian) Division from Antwerp to Louvain; the 5th Division from Mons to Perwez; the 6th (Belgian) Division from Brussels to Wavre. The 4th (Belgian) Division remained at Namur for the mobile defence of this fortress. The foregoing movements were covered by the Belgian Cavalry Division which, having concentrated at Gembloux, was pushed forward to Waremme, by a mixed brigade of the 3rd (Belgian) Division occupying Tongres and by a mixed brigade of the 4th (Belgian) Division moved to Huy for this purpose; this concentration of the Belgian Army, which was effected partly by road and partly by rail, was completed on the 5th August; in accordance with the terms of the Constitution of Belgium the supreme command of the forces in the field was at once assumed by King Albert. On the day following, the whole Belgian Army had been provided with its full transport and was ready to execute any move ordered.

On a war footing each division of the Belgian Field Army constituted a self-contained unit, consisting of from three to four mixed brigades, one regiment of divisional cavalry, one regiment of divisional artillery, one battalion of engineers (two companies), a field telegraph section, one divisional supply column. Each mixed brigade was composed of two infantry regiments (of three battalions each), a brigade of artillery (three batteries), a machine-gun company, and a platoon of gendarmerie. The Cavalry Division comprised two cavalry brigades, one cyclist battalion, one horse artillery brigade (three batteries), one cyclist-pioneer-bridging company, one divisional supply column. The total strength of this Field Army was 117,000 men, to which were added later 18,500 volunteers.

After the German troops had violated Belgian territory, King Albert's Ministers addressed a Note to the guaranteeing powers in which was expressed the intention of the Belgian nation to resist the German intrusion, and these powers were asked for their co-operation to assist Belgium to maintain her independence and the integrity of her dominions. The Ministers stated in this Note: "Belgium is in a position to furnish an assurance that she will defend her fortified centres."

It was realized in Belgium from the tenour of the German Note of the 2nd August that, if the German armies must pass through Belgian territory, the Meuse would by no means fix the limit of ingress into Belgium, but that the river line would merely be the base from which would be launched the offensive movement against France, an offensive in which German troops would take part in strength far superior to anything Belgium could oppose to them.

In consequence, the following principles were laid down as a guide for the action of the Belgian Army:—

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I. In the event of the Belgian Army having to meet forces far superior to itself :

(i.). It was to hold on to its ground, by occupying good defensive positions barring the lines of advance open to the enemy ; the object in view being to cover as great an extent of territory as possible against invasion.

(ii.). The Belgian Army, forming as it were an advanced guard to the French and British forces, was to await in the positions taken up by it the arrival of the armies of these Allies.

(iii.). If it became impossible to effect a junction between the Belgian Army and the troops of France and Great Britain owing to the earlier arrival of large masses of enemy troops, the Belgian troops were not to run the risk of severe loss, involving in any case a surrender of territory, and consequently—

(*a*). The Belgian Army was on no account to deliver an attack single-handed against superior masses.

(*b*). The Belgian Army was to prevent itself from being enveloped ; indeed on the contrary, it was so to act as to secure its line of communications with a view to forming ultimately a junction with the French and British forces for the purpose of acting in co-operation with them.

II. In the event of the Belgian Army having to meet forces equal only in strength to itself :

It was to attack the enemy at the most favourable opportunity, that is in the event of the positions occupied being too extended, insufficiently organized, etc.

In both cases the Belgian Army was called on to defend Liège, Namur and the entrenched camp of Antwerp. The events which occurred on the Meuse and before Liège in the early days of August rendered it necessary for the Belgian General Staff to reconsider completely their plans and to modify them to a very considerable extent.

The Defence of the Fortified Position of Liège.—The second chapter deals briefly with the early combats near Liège and the German assault on the defences of this centre. On the 4th August, two German Cavalry Divisions (the 2nd and 4th, comprising about 12 regiments) had crossed the Belgian frontier and invaded the Herve district. These Cavalry Divisions made direct for Visé and on their arrival there found the bridge across the Meuse destroyed. The 2nd Battalion of the 12th (Belgian) Infantry Regiment had been posted at this point to deny the passages across the river to the enemy ; this battalion held in check the superior force of German

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cavalry in front of it, although the latter was quickly supported by artillery and infantry pushed forward in motor vehicles. However, two regiments of German Hussars crossed the river lower down by the ford at Lixhe; realizing that their flank was turned, the Belgian infantry retired into Liège.

Behind the German cavalry referred to there marched a force of all arms belonging to the VII., VIII., IX., X. and XI. German Corps; this German force advanced rapidly into Belgium and by midday of the 4th August had reached the line Bombaye-Herve-Remouchamps. At the same time intelligence was received that the III. and IV. German Corps were concentrating at St. Vith and to the north of this place (about 9½ miles south of Malmedy). Thus seven German Army Corps, comprising 300,000 men, were at this time massed on the routes leading into Belgium which converged on to the fortress of Liège.

The Germans bridged the Meuse at Lixhe on the 5th August and pushed cavalry patrols to Tongres, and on the same day a German cavalry regiment engaged a squadron of the 2nd (Belgian) Lancers at Plainevaux, south of Liège; the latter charged the Germans and doing so lost 75 per cent. of its men.

On the same morning, a parlementaire arrived in Liège and demanded from the military governor of the fortress an unopposed passage for the German Army. His request being peremptorily refused, the Germans delivered a vigorous attack on the detached forts on the east and north-east of Liège; although heavy artillery was brought against these works, the German attack was everywhere repulsed with heavy loss to the assailants. The most serious effort made by the Germans was that in the region north-east of Liège, between Fort Barchon and the Meuse; the enemy forced the Belgian lines in this locality, but an energetic counter-attack delivered by the 11th (Belgian) Brigade broke up the Germans who retired in disorder. Thus the attack on the sector between the Vesdre and the Meuse (north of the former river) failed.

A vigorous attempt was made on the night of 5th—6th August to break the Belgian line between the Meuse and the Ourthe, south of Liège, with fresh troops. On the same night, a party consisting of two German officers and eight troopers penetrated into Liège and attempted to seize the Military Governor; they failed to do so, being all killed. The assaults of the X. German Corps against the sector between the Meuse and the Ourthe compelled the Belgian troops defending the intervals between the forts in this region to retire. Portions of the 9th, 12th and 15th (Belgian) Brigades (belonging to the 4th Division) were sent forward from Huy and checked the Germans by their counterstrokes.

The Belgian troops belonging to the 3rd Division had been engaged since the 4th August on a very extended front; they however repulsed

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the furious attacks of an enemy possessing a fourfold greater strength at this point, they thus escaped the fate of being entirely surrounded. It was now necessary for these advanced Belgian troops to unite with the main army, the concentration of which had just been completed. All the Liège forts were still held by their permanent garrisons, but the Military Governor had come to the conclusion that they were no longer able to play the *rôle* of *forts d'arrêt;* he withdrew, with his staff, from the town of Liège and established his headquarters in the Fort de Loncin, on the west of Liège, towards midday on the 6th August.

The mobile Belgian troops, engaged in the defence of Liège, were next collected between the forts of Loncin and Hollogne, and marched westward; the 3rd (Belgian) Division reached the Geer on the evening of 6th August and continued its march to the Gette where it made junction with the main Belgian Army. This march was made without molestation from the German troops, only small parties of Uhlans being encountered. During the days immediately succeeding the departure of the 3rd (Belgian) Division the Liège forts continued to fire on German troops passing within range of their guns. Towards midday of the 12th August the Germans opened fire on the forts on the right bank of the Meuse with their heavy artillery of large calibre, and by the 17th *idem* the last of the Liège forts fell into their hands.

The Combined Operations of the Belgian Army in Conjunction with the Armies of the Allies during the Period 6th—20th August.—The third chapter records the events which took place immediately after the Belgian Army joined up with the British and French forces. By the 6th August, the concentration of the Belgian Army had been completed in the quadrilateral Tirlemont-Louvain-Wavre-Perwez, two marches distant from Liège. At this time, the 3rd (Belgian) Division was retreating towards this quadrilateral from Liège. The enemy had crossed the Meuse to the north of Visé; he had attacked Liège with three Army Corps, and other German Army Corps had been collected to the east and south-east of the last-named town.

The first defensive line on the western frontier of Belgium which the Belgian Army might have attempted to hold extended along the Meuse from Givet to Namur, prolonged thence northward along the Gette; the left of this position rested on the Demer. The general direction of this position was very suitable for barring an offensive movement from the east into Belgium, given sufficient troops to hold the whole extent of the line. However, the Belgian Field Army was not by itself strong enough in numbers to hold the whole position; it was sufficient to occupy the portion of the line along the Gette only, in order there to await the arrival of Allied troops required for the purpose of holding the portions of the line between the Belgian right and Namur and thence to Givet.

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The Belgian Army whilst massed along the Gette was in a good position to cover Brussels and ran little risk of being cut off from Antwerp; the latter stronghold formed the base from which the Belgian Army drew its supplies of all kinds and in this city it was intended to establish the seat of government when Brussels had to be evacuated. The left of the position actually taken up rested on the river north-west of Tirlemont and the right on Jodoigne. The 1st and 5th (Belgian) Divisions held the first line, and in the second line were placed the 2nd (Belgian) Division at Louvain and the 6th (Belgian) Division at Hamme-Mille.

When the 3rd (Belgian) Division reached the Gette, it took up its position in the first line between the 1st and 5th Divisions. The (Belgian) Cavalry Division covered the front occupied by the three divisions referred to; it was at first located in the neighbourhood of Waremme, thence it retired towards the left of the Gette position on St. Trond and finally fell back on to the Gette, extending the Belgian left to Diest. The 4th (Belgian) Division remained at Namur and formed a *point d'appui* to the Gette-Namur position.

At this time the permanent garrisons of the Liège forts were still holding out and the 8th Mixed (Belgian) Brigade which had been detached by the 4th Division to replace the 15th (Belgian) Brigade pushed into Liège, was in occupation of Huy.

German cavalry, supported by Jäger Battalions, appeared before the Belgian troops on the 10th August. Skirmishes were taking place between cavalry patrols almost daily about this time; the German cavalry next became active about Hasselt and Diest, and the Belgian Cavalry Division came into collision with this part of the enemy's forces at Budingen and Haelen.

On the 12th August the German cavalry attempted to force a passage across the Gette at Haelen: the enemy's troops consisted of six regiments of the 2nd and 4th Cavalry Divisions, the 7th and 9th Jäger Battalions and three batteries of artillery, comprising 4,000 sabres, 2,000 rifles and 18 guns. The Belgian Cavalry Division opposing this German force consisted of 2,400 troopers, 410 cyclists and 12 guns, and were therefore hopelessly outnumbered; however, an unequal combat was gallantly continued by the Belgians from 8.30 a.m. to 3 p.m.; at 10 a.m. the western limits of Haelen were rendered untenable owing to the fire of the German batteries, the Belgian cyclists therefore blew up the bridge over the river and retired on to the railway. By noon the enemy was already west of Haelen and delivered attacks simultaneously on the railway station at the place last named and also on the village of Zelch. The Belgian cyclists who had been hotly engaged for five hours were obliged to retire from the railway station and were charged by a squadron of German dragoons, but their fire was too intense for the German cavalry to make headway against, and the enemy

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therefore deployed his reserves on the line Velpen-Liebroeck and supported the attacking troops by machine-gun and artillery fire. The Germans appeared to be about to carry everything before them, when at 3 p.m. the 4th Mixed (Belgian) Brigade (consisting of four battalions of the 4th and 24th Regiments) arrived on the scene; this brigade had made a magnificent march of 15½ miles in 5½ hours in the sweltering heat. Leaving Haekendover at 9.30 a.m. it arrived at Loxbergen in the nick of time. In spite of the fact that the men were tired after their long march they came rapidly into action and rushed the village of Velpen, where they came under the fire of German machine guns hidden in the houses. The Germans counter-attacked vigorously, supported by a heavy fire from their artillery, but at 3.30 p.m. the three batteries of the 4th Mixed (Belgian) Brigade were able to take up a position from which they silenced the German guns. At 6 p.m. the Germans ceased their attacks and retired on Haelen, leaving their dead and wounded on the field. The fight at Haelen was but an episode in the great onward move of the German forces.

According to the intelligence collected up to the 17th August the presence of numerous bodies of German troops had been reported in the area Wilderen-Lummen-Asch-Tongres, opposite the left of the Belgian Army on the Gette, and a continuous stream of the enemy's forces were also reported to have been moving westward across the military bridges thrown across the river at Lixhe; the arrival of a part of the enemy's main body, opposite the Belgian centre, that is, about Esemael, Landen, Waremme and Hannut, had been announced, whilst other parts of his main body were said to be on the Belgian front about Huppaye, Jauchelette, Pietrebais. German troops had also been reported to be crossing the Meuse at Ampsin and to have constructed bridges at Huy. The situation had become exceedingly critical by the morning of the 18th August.

On the date last mentioned, the Belgian Cavalry Division was attacked along the whole front, Budingen-Diest, occupied by it; it offered a strenuous resistance, especially at Diest. It was, however, not able to hold on to its positions and retired towards the Dyle, north of Louvain, whilst at the same time the 2nd (Belgian) Division was sent forward to prolong the left of the Belgian line on the Gette.

Further south the Germans attacked the 1st (Belgian) Division; pushing back the outpost troops, they occupied Tirlemont and delivered a frontal and also a flank attack on the Belgian position at Hautem St. Marguerite (about 2 miles north of Tirlemont). The 2nd (Belgian) Brigade held on obstinately to the positions allotted to it and sacrificed itself in the attempt; this sacrifice was not in vain, for it allowed the remainder of the division to withdraw in good order.

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The intelligence collected by the General Staff of the Belgian Army left no doubt that the German forces were advancing on the front and flanks of the Belgian Army in numbers far superior to the latter. A considerable danger existed at this time of the Belgians being cut off from Antwerp by the German forces moving on Diest and Aerschot.

On the 18th August, the following German troops were on the left bank of the Meuse:—The II., IV. and IX. Corps which were advancing against the Belgian left on the line Diest-Tirlemont, the left flank of these corps was covered by the 2nd German Cavalry Division which was moving between the rivers Grande Nethe and Demer; the III., VII. and X. Corps, which had crossed the Meuse between Liège and Huy, were marching towards the front, Jodoigne-Namur, and were covered by the 4th and 9th German Cavalry Divisions advancing on Wavre and Gembloux. The foregoing six corps of the first line were being followed by five reserve corps.

Thus, independently of the German forces set in motion against France across the Belgian provinces of Luxemburg and Namur, some half a million of German troops were already operating on the left bank of the Meuse against the Belgian Army.

On the 18th August, the situation as regards the troops of the Allies was as follows:—The 5th French Army had one corps holding the bridges over the Meuse at Hastiere (about 15½ miles south of Namur) and the bridges over the Sambre between Tamines (about 13½ miles from Namur) and Floreffe (about 6 miles from Namur); the remaining three corps of this army were due to arrive in the neighbourhood of Philippeville (about 14 miles south of Charleroi) on the 19th August. This army was threatened by a German force, reported to consist of four corps, which had reached the line Yvoir (about 9 miles south of Namur)-Beauraing (about 25 miles south of Namur); it had delivered an attack on Dinant on the evening of the 17th August.

The British troops were at this time being derailed south of the Sambre in the neighbourhood of Maubeuge; the British cavalry had already completed its derailment, the remainder of the troops, it was expected, would probably be ready to advance into Belgium on the 22nd August, or the 23rd at latest.

In short, at this time the Belgian Army, comprising about two Army Corps, was in immediate contact with 11 corps belonging to the German I. and II. Armies; it was isolated and no combined operations in conjunction with French and British troops was possible.

A decision had to be taken without delay by the Belgian General Staff as to their next step. It was clear that if the Belgian Army remained in position on the line of the Gette it could not hope to do anything useful against the immensely superior German armies

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which were on its front and threatening both its flanks; defeated in this position the remains of the Belgian Army would have been cut off from its supplies of food and ammunition at Antwerp. It had occupied its waiting position for 13 days, from the 5th—18th August, and during this time it had held at bay the German cavalry and advanced troops and caused them to lose time which was very precious. In view of the situation, at midday on the 18th August, King Albert decided to issue orders for his army to retire in a north-westerly direction, and at 7.30 p.m. these orders were in the hands of the commanders of the several units; these commanders were directed to retire at dusk, so as to be in position by daybreak next morning on the left bank of the Dyle, on the line Neeryssche-Louvain-Rotselaer (a front of about 10 miles). Whilst this movement was in progress the II. German Corps was being rapidly pushed forward to outflank the Belgian left and at dawn on the 19th August it came into collision with a brigade of the 3rd (Belgian) Division retiring on Aerschot which fought a rear-guard action. The German enveloping movement had progressed so rapidly that it was soon clear that the Belgian Army would not be able to occupy the position ordered on the previous evening. In consequence, a hurried retirement on to the forts of Antwerp took place and on the 20th August the Belgian Army gained the shelter of this fortress without having become seriously compromised in its retreat. It was now in a position to play a new *rôle* in co-operation with the Allied troops, that of holding a German force, at least equal to its own strength, in the neighbourhood of Antwerp.

The Germans pursued the Belgian Army; they arrived at Louvain on the 19th August, Brussels on the 20th *idem*, and it was thus not till the 24th August (on the 23rd day of mobilization) that they crossed the northern frontier of France, this great delay being entirely due to the tenacity with which the Belgian Army held on to its positions and the many sacrifices made by the Belgian soldiers in the cause of their Allies.

The Defence of the Fortified Position of Namur.—The fourth chapter of the Report is devoted to the operations which took place between the 5th—25th August round Namur. Namur was defended by nine detached forts, and as already explained the mobile defence of this region was entrusted to the 4th (Belgian) Division. German cavalry patrols had been in collision with Belgian cavalry patrols in the Condroz district (south-east of Namur) since the 5th August and in the Hesbaye district (north-west of Namur) since the 7th *idem*. On the 15th *idem*, German troops attempted to force the passage across the Meuse at Dinant, but were driven off by a French force holding the valley here. On the date last mentioned, the 8th (Belgian) Brigade, which had been holding Huy, finding that it ran the risk of being surrounded by the Germans, destroyed the bridges

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over the river in that neighbourhood and retired towards Namur. On the 19th August, this brigade destroyed the bridges and obstructed the railway tunnel at Seilles and fell back from Andenne (on right bank of Meuse, about 10 miles eastward of Namur) on to the fortress of Namur.

On the date last mentioned, intelligence was received of the presence of large forces of German infantry and artillery about Faulx (about 5½ miles south-east of Namur) and about Ramillies-Offus (about 11 miles north of Namur); the German troops were accompanied by guns of very large calibre. On the 20th August, the Germans began to push back the Belgian advanced troops in the north-east sector of the Namur defences; at the same time, it was discovered that they had established siege batteries against the south-east sector of the Belgian defences, and the Belgian artillery opened fire against these siege batteries. During the night of 20th—21st August, German infantry made three attempts to penetrate between the intervals on either side of Fort de Marchovelette (the first of the detached works north of the Meuse) N.E. of Namur.

The bombardment of the four forts and works in the intervals on the north-east and south-east sectors of the Namur defences was commenced at 10 a.m. on the 21st August, from the commencement it was extremely violent, and for four hours the town itself was subjected to a rain of shell. By the evening, two of the forts had been seriously damaged and the telephonic communications with three of them were completely interrupted. This bombardment was kept up during the night.

On the morning of the 22nd August, the Namur garrison pushed out troops towards the German lines; these were met by well-directed rifle and machine-gun fire. The German bombardment against the Namur forts was as intense on this date as on the previous day. At 10 a.m. three French battalions (two of the 45th and one of the 148th Regiment) arrived on the scene; advantage was taken of their arrival to attempt an attack on the enemy's artillery reported to be in position on the left bank of the river about 4,500 yards from the north-east outskirts of Namur. Shortly after this attack commenced the Belgian field artillery taking part in the operation had to cease firing and the other troops engaged were therefore withdrawn. In the meanwhile the town of Namur had been subjected to a renewed bombardment; three of the forts in the north-east and south-east sectors still remained in action, but the fort on the right bank of the river, almost due east of Namur, had been so completely destroyed that it had to be evacuated, whilst the next fort to it on the left bank of the river, which had been the target for a systematic bombardment, had had the last of its cupolas knocked out. There was no interruption in the bombardment during the night of 22nd—23rd August and at daybreak next morning the fire of the large calibre

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German artillery was turned on to the northernmost of the Namur forts; later an infantry assault on this fort was repulsed, but towards midday the Germans seized the fort. The German artillery was now turned against the two forts on the north-west sector of defence. The forts and the defence works in the intervals were one by one reduced to silence; on the north-east and south-east only was the Belgian field artillery able to reply to the enemy's fire and soon they also had to cease their activities and the Belgian troops in these sectors then retired into Namur.

The position of the 4th (Belgian) Division became, at this time, precarious. As the enemy was now on the left bank of the Meuse in considerable numbers and had forced the passages of the Sambre between Charleroi and Namur and those of the Meuse about Dinant the only lines of retreat left to the 4th (Belgian) Division lay in the region between the Sambre and the Meuse. Consequently, the commander of the 4th (Belgian) Division decided to withdraw his troops from Namur and retired south along the left bank of the Meuse, bivouacking at midnight of the 23rd—24th August between Arbre and Bioul (about 7½ miles south of Namur). The Germans threatened this Division in rear and on the flanks, but it succeeded in extricating itself with the loss of its rear guard which was surrounded at Ermeton-sur-Biert (about 13½ miles southward of Namur). Some 12,000 men succeeded in gaining Mariemburg (about 30 miles south-west of Namur) and France (frontier about 12 miles from Mariemburg). Ten days later this Belgian force entered Antwerp, and in spite of the difficulties of the retreat it arrived at the entrenched camp in good order and without having suffered any considerable loss.

The last of the Namur forts to surrender was the most westerly one known as Fort Suarlée; it did so, on the 25th August, after having been subjected to a most intense bombardment.

Operations in Co-operation with the Armies of the Allies during the Period 20th August—27th September.—In the fifth chapter a short account is given of the operations carried out by the Belgian, French and British Armies between the 20th August and the 27th September. On the 20th August, the Belgian Army had taken up a position on the Rupel and the Nethe, resting on the line of forts defending Antwerp; it had a detachment at Termonde. The Belgian Army had now to subordinate its operations to meet the requirements of the French and British forces. The principal part which it was called on to play was to hold as large a part as possible of the German forces in the neighbourhood of Antwerp; to do so effectively it was necessary for the Belgians to act offensively with vigour against the Germans whenever an important engagement took place between the Franco-British Armies and the German forces, and also in the event of the Germans at any time locating their troops in the immediate neighbourhood of the Antwerp defences to such an

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extent as to give the Belgians the opportunity to strike with a considerable chance of gaining a success.

Up to the 25th September the German forces in the neighbourhood of Antwerp remained about equal in numbers to the Belgians holding the positions south of that city, but on the date last mentioned the Germans in this region received such considerable reinforcements as profoundly to modify the situation.

In the operations which were now in progress on a very wide front, the Belgian Army had to bear in mind that for purposes of combined action with the Franco-British forces a line of retreat to the westward must be kept open, at all costs, whereby a junction could ultimately be effected between the Belgian forces in Antwerp and the Allied Armies operating further south; and as a subsidiary task the Belgian troops had to be prepared to undertake enterprises against the German lines of communication, as and when an opportunity offered for carrying such an operation through successfully.

The following operations were undertaken by the Belgian Army, based on Antwerp, in order to fulfill its mission on the lines indicated above:—

On the 21st August, the main body of the German forces which had pursued the Belgians to Antwerp moved south on to the Sambre and Hainaut. In its place, a German *armée d'observation* was left in front of the Antwerp defences; this army consisted of the III. and IX. Reserve Corps. At the same time, the 13th Reserve Division and one or two Landwehr battalions were posted in the neighbourhood of Liège. These Reserve Corps had just arrived before Antwerp, on the 24th August, when the Belgian General Staff learnt of the severe fighting in progress on the Sambre and at Mons. The circumstances appeared favourable for a sortie on the part of the Belgian troops in Antwerp, and an operation of this nature was carried out on the 25th and 26th August with the object of breaking through the position held by the III. and IX. German Corps in order to threaten their lines of communication. The Germans were driven from some of the villages south of Malines held by them, but when it became known at the Belgian headquarters that the fighting on the Sambre and at Mons had ceased it was concluded that nothing would be gained by prolonging the operations in this region and the Belgian Army was withdrawn once more to the shelter of the Antwerp defences.

On the 4th September, a German force marched on Termonde and, having driven the Belgian detachment holding this town out of their positions, it crossed the Scheldt. The Belgian communications with Ostend were now threatened and the 1st and 6th (Belgian) Divisions were, therefore, moved across to the left bank of the Scheldt. The enemy at this time recrossed to the right bank of the river, and Termonde was once more in Belgian hands. From this

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date, the efforts of the enemy to pass to the west of the river were checked and the Belgian line of retreat to the west thus secured.

On the 7th and 8th September, intelligence reports indicated that the Germans had withdrawn a part of their forces watching Antwerp. As a matter of fact, three divisions of the *armée d'observation* had been moved south to reinforce the German troops retreating from the Marne to the Aisne and were replaced by a division of German Marines and by the 26th and 37th Landwehr Brigades.

A sortie was decided upon by the Belgian General Staff with the object of turning the German right. Five Belgian divisions and the Belgian Cavalry Division took part in these operations; these troops were set in motion on the 9th September and brought the operations to a successful issue. On the date last mentioned, the Belgians wrested the passages over the Demer and Dyle out of German hands and seized Aerschot. On the day following, the Belgian offensive was continued towards Louvain and a troop of Belgian *Chasseurs à cheval* entered the town; on the other hand, the 2nd (Belgian) Division was checked about 2½ miles north of Louvain. In order to hold the Belgians, the 6th German Reserve Division was hastened back from France to Antwerp.

On the 11th September, the 3rd (Belgian) Division drove back the Germans at Over de Vaart (midway between Malines and Louvain); and the 6th (Belgian) Division seized the railway in the same neighbourhood.

On the 12th September, the 6th German Reserve Division, having reached a point some 4 miles north-west of Louvain, in its turn assumed the offensive and drove the 2nd (Belgian) Division eastwards towards Aerschot; this move necessitated the retreat of the 6th and then the 3rd (Belgian) Divisions.

On the 13th September, the entire Belgian Army was once more back within the defences of the entrenched camp of Antwerp, having successfully accomplished its purpose. These operations not only caused the 6th German Reserve Division (III. Reserve Corps) to be recalled to Antwerp, but as was learnt later, the offensive of the Belgians brought about a delay of two days in the southward march of the IX. German Reserve Corps, just at the time that the German armies had commenced their retreat from the Marne and these reinforcements were urgently needed. This sortie further caused grave misapprehensions in the enemy's camp at Brussels.

The Germans now began to take the necessary steps to lay siege to Antwerp and brought up powerful guns and a large mixed force for the purpose.

On the 13th September an equality between the forces of the besieged in Antwerp and of the besiegers was again established: the Germans continued to strengthen their positions south of Antwerp.

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During the next few days seven detachments, each consisting of 100 volunteer cyclists, were organized in Antwerp for the purpose of interrupting the railways in Belgium. A definite zone was allotted to each of these detachments which set out from Antwerp on the 22nd September; they succeeded in interrupting the principal railways in the provinces of Limburg, Brabant and Hainaut and thereby caused the Germans considerable inconvenience. The greater part of these detachments returned to Antwerp on completing the tasks allotted to them, a few only of those taking part in the enterprise were captured or killed.

On the 25th September, the French General Staff suggested to the Belgian General Staff that, as violent attacks were in progress on the Franco-British left, the moment was opportune for further enterprises against the German lines of communication.

Whilst the preliminary measures were in hand in connection with an attack by the Belgian troops on the German communications, it was definitely established that the German troops in the neighbourhood of Antwerp had been considerably increased, and that the measures in relation to a regular siege of the entrenched camp were in an advanced stage of preparation. In consequence, the idea of executing any further enterprises on a considerable scale against the German communications had to be abandoned. However, the 37th Landwehr Brigade, having been left in an isolated position in the neighbourhood of Termonde, orders were given to the 4th and 5th (Belgian) Divisions and the Cavalry Division to attack this brigade: the results hoped for were not attained as the 5th (Belgian) Division found its own left flank to be threatened and therefore could not carry out its orders.

The Defence of the Entrenched Camp of Antwerp.—The sixth chapter of the Report gives an account of the attempt of the Belgian Army to hold on to their great arsenal and base of supplies. The German Army detailed for the Siege of Antwerp consisted of the III. German Reserve Corps, the 26th and 37th Landwehr Brigades, one division of Marines, the 4th Ersatz Division, the 1st Reserve Ersatz Division, one Bavarian Division (probably), one artillery brigade, and one brigade of siege pioneers.

The siege operations against Antwerp commenced on the 28th September; at this time the bulk of the Belgian Army was in the 4th Sector of Defence (roughly from the junction of the Rupel with the Scheldt eastward to junction of the Dyle with the Rupel). The 2nd, 3rd and 6th (Belgian) Divisions had each left a battalion of infantry, a cavalry regiment, a company of cyclists and a brigade of field artillery in the 3rd Sector of Defence (roughly from the junction of the Dyle with the Rupel northward to the junction of the Grande Nethe with the Petite Nethe at Lierre) in order that this sector should be made secure. The 2nd (Belgian) Division was held

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as a general reserve to the troops holding the 3rd and 4th Sectors of Defence. The enemy drove back the detachment of the 1st (Belgian) Division which had been holding the southern limits of Malines early in the day and bombarded the forts of Waelhem and Wavre Ste. Catherine, situated in the angle formed by the Dyle and the Nethe, with guns of large calibre. The fire from the 16·5-in. howitzers soon made itself felt against the latter of these two forts. The General Staff in Antwerp moved the 1st and 2nd (Belgian) Divisions in haste into the 3rd Sector of Defence, retaining at the same time the 3rd and 6th (Belgian) Divisions in the 4th Sector; the 4th (Belgian) Division was at Termonde, whilst the 5th (Belgian) Division formed a General Reserve.

The Germans attacked the 4th Sector on the 29th September and drove back the advanced posts of the 3rd and 6th (Belgian) Divisions. On the same day, the intensity of the bombardment directed against the 3rd Sector caused the Belgian advanced posts on this front to retire also to the line of the forts. The works between the Petite Nethe and the Grande Nethe next came under the fire of the siege guns. The forts of Waelhem and Wavre Ste. Catherine had a particularly trying time on the date last mentioned; a magazine in the latter was blown up and at 6 p.m. both of them had suffered so much damage to their masonry work that the garrisons were obliged to evacuate them.

The effects which could be produced by the German heavy artillery had already been disclosed by the nature of the destruction wrought earlier at Liège, Namur, and Maubeuge and, on this 29th September, the damage done to the forts of Waelhem and Wavre Ste. Catherine left little doubt in the minds of the responsible authorities as to the fate which was in store for the fortifications of Antwerp. It was clear that the great Belgian entrenched camp could no longer be considered a secure refuge for the Belgian Field Army.

The Belgian General Staff now felt that the question of abandoning Antwerp, before it was too late to withdraw the field army, would have to be faced. The first thing to be done was to select a new base; the choice fell on Ostend and to this place were immediately transported the wounded, the German prisoners, supplies of all kinds, the depôts, recruits belonging to new levies, volunteers under training, the administrations of the factories, etc., etc. The base having been removed from Antwerp, the army regained its liberty of action, it could now continue as a living force either within Antwerp or without it, and it was in a position to quit the place as soon as the Germans began to close in round the entrenched camp.

The only available line of railway from Antwerp to Ostend was that on the left bank of the Scheldt, *viâ* St. Nicholas and Ghent; Antwerp itself lies on the right bank of the river and there is no

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railway connection within the city between the two banks of the river. The first railway bridge across the river is that at Tamise, just outside the outer line of forts south-west of the city, and to reach this bridge it was necessary to pass over the bridge of Willebroeck which was itself under the enemy's artillery fire. However, the arrangements which had been made worked so excellently that trains travelled throughout every night between the 29th September and 7th October with their fire-boxes so well screened that the enemy's attention was not attracted and the trains were in consequence unmolested.

The preparations for the withdrawal of the army were next completed; but it was still necessary to provide for the protection of the lines of retreat. Further, the situation dictated that the Belgian Army should hold on to Antwerp as long as possible, in order to give the French and British troops every chance of coming north so as to prolong the Belgian line southwards along the line of the Dendre, at its junction with the Scheldt at Termonde.

The situation here was similar, to all intents, with that which existed earlier in the War when the Belgian Army took up a position on the line of the Gette.

The Belgian Army now took up positions as follows:—Five divisions (the 1st, 2nd, 3rd, 5th and 6th) occupied a line in front of the Rupel and the Nethe in defence of the forts threatened; the 4th Division held Baesrode, Termonde and Schoonaerde on the Scheldt and covered the line of retreat to the coast; the Cavalry Division was based on Wetteren and had the left bank of the Dendre under observation, it therefore effected a purpose similar to that undertaken by the 4th (Belgian) Division. So long as the enemy had not crossed to the west of the Dendre, no serious risk was being run of the Belgian line of retreat being cut.

Between the 30th September and 6th October, the Germans continued their attack on the detached forts of Antwerp and the intervals between them; by degrees the fire of the heavy guns began to play havoc with the masonry of the forts, cupolas were knocked out of their pits, the concrete was fissured and in some cases the enemy penetrated into the forts and completed the work of destruction by mining.

On the evening of the 3rd October, when many of the forts had already been rendered untenable, one of the newly-raised British Marine Brigades consisting of 2,200 men marched into Antwerp, and on the 4th *idem* it relieved the 1st Mixed (Belgian) Brigade holding the position in front of Lierre (about 9½ miles south-east of Antwerp). On the date last mentioned, the Germans commenced to bombard the defences to the north of the Nethe and drove back the Belgian troops which had been holding the defences in the fork of the Grande Nethe and the Petite Nethe; at the same

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time they crossed to the left bank of the Dendre and attempted to force the Scheldt at Termonde and Schoonaerde.

On the 5th October, the Germans occupied Lierre but were unable to advance beyond this town; they succeeded however in crossing the river below Lierre. New attacks were now launched by the Germans against the troops holding the line of retreat, notably those at Schoonaerde; they were repulsed everywhere, but the position of the 4th (Belgian) Division had commenced to become critical.

On the 6th October, the besiegers made a determined general attack on the position to the north of the Nethe. The 1st, 2nd and 5th (Belgian) Divisions, which had been reinforced by the 3rd and 6th (Belgian) Divisions and the British Marine Brigade could no longer hold on to their positions in view of the violence of the German artillery attack and yielded ground. Several counter-attacks were delivered by the besieged, who in some cases gained the banks of the Nethe, but the German advance could not be checked.

On the date last mentioned, the Germans made further efforts to force the passages of the Scheldt at Baesrode, Termonde and Schoonaerde but the 4th (Belgian) Division and the (Belgian) Cavalry Division succeeded in holding up the enemy. In response to the call for assistance from the commander of the 4th (Belgian) Division, the 6th (Belgian) Division received orders at 10 a.m. to cross the Scheldt at Tamise for the purpose of supporting the 4th Division.

The enemy having at this time crossed the Nethe and the Dendre, the position of the Belgian Army had indeed become critical.

Operations in Co-operation with the Armies of the Allies during the Period 6th–15th October.—The seventh chapter of the Report deals with the fall of Antwerp and the operations immediately subsequent thereto. Up to the beginning of October the main consideration before the Belgian General Staff was how to avoid the danger of the Belgian Army being shut up for good in Antwerp by a complete and close investment of this entrenched camp by the German troops. A new danger now threatened the Belgian Field Army. The retreat of the German forces from the Marne had, on the 13th September, brought their right wing back to Lassigny.

From the date last mentioned, both the German and the Allied Armies in France commenced to manœuvre with the object of the one outflanking, if possible, the westernmost wing of the other. The German right wing had thus been pushed further and further northwards from Lassigny and, at the beginning of October, had reached the neighbourhood of Lille. The Belgian Army consequently found itself in the predicament that after all it might be entirely cut off from the Franco-British forces if the German right wing continued to extend northwards; the distance from Lille to the sea at Nieuport is approximately 37½ miles, whilst that from the

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Nethe to Nieuport is 87½ miles, that is to say more than twice as great. Therefore, in the first days of October, the line of retreat from Antwerp was threatened not only by the German troops besieging that city, but also by the right wing of the German Armies operating in France.

If then it was desired to maintain intact the Belgian Field Army in Antwerp, it became imperative that its line of retreat to the west should be more effectively secured than was the case at the date in question. For this reason, it became necessary to occupy the railway junction at Ghent which was approximately at the same distance from Lille as it was from the position on the Nethe still held by the Belgian Army.

The Belgian General Staff, being convinced of the importance of Ghent and having no troops available to despatch to this centre, represented the urgency of the matter to the British Government, pointing out that the securing of Ghent would enable the defence of Antwerp to be prolonged. The British Government promised to send the 7th (British) Division to Belgium at once; and it was arranged that French troops would also co-operate to secure the Belgian line of retreat on Ostend.

The situation on the evening of 6th October was as follows:—The Germans had pierced the Belgian line on the Nethe; they had crossed the Dendre and the Scheldt and were attacking with considerable energy the Belgian troops holding positions on these rivers; the German forces in the Antwerp region were steadily increasing and it was clearly out of the question for the Franco-British forces to make a junction in Antwerp with the Belgian Army holding the defences in the entrenched camp; the occupation of Ghent by the Allies had been assured; the last of the military supply trains for Ostend had left Antwerp between 6 and 7 p.m. on this date.

It was still possible for the Belgian Army to withdraw from Antwerp, but there was no time to lose; it was therefore necessary to set the troops in motion on their westward march without further delay.

King Albert ordered his field army to cross to the left bank of the Scheldt between the hours of 6 and 7 p.m. by the bridges at Tamise Hoboken (about 3 miles south of Antwerp) and Burght (about 1¾ miles south of Antwerp), and to march westward. The garrison troops of Antwerp were to continue to defend the detached forts and other works, with the assistance of a few regiments of (fortress) infantry, the 2nd (Belgian) Division, three brigades of British Marines; two of the latter had arrived in Antwerp the day before (5th October).

The retreat commenced on the evening of the 6th October and at 7 a.m. next morning the whole of the Belgian Army had arrived safely on the left bank of the Scheldt. King

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Albert left Antwerp between 7 a.m. and 3 p.m. on the 6th October. The retreat had not been commenced any too soon, for on the 6th October, the Germans forced a passage across the Scheldt at Schoonaerde. The 6th (Belgian) Division contained the enemy at Berlaere; the presence of German forces south of Ghent was also reported, but as the Franco-British troops expected at the last-named place had not arrived there yet, the 4th (Belgian) Brigade was rapidly pushed forward to Ghent to check the Germans in that neighbourhood.

On the 8th October the enemy came into collision with the 3rd (Belgian) Division in the neighbourhood of Lokeren, about 7 miles north-west of Termonde; the same evening, the 1st (Belgian) Division was conveyed by rail from St. Nicholas to Ostend, whilst the remaining divisions marched on towards the Terneuzen Canal (running northwards from Ghent).

On the 9th October, the 37th Landwehr Brigade and the 4th Ersatz Division reached the neighbourhood of Lokeren; at the same time, the 1st Ersatz Division and a Bavarian Landwehr Division advanced towards Ghent; however, a French Brigade of Fusilier Marines had already occupied the last-named place and, on this day, a considerable part of the 7th (British) Division also arrived in Belgium. Ghent and its approaches on the east and south-east were, in consequence, now occupied by from 25,000 to 30,000 men.

The German troops which had crossed the Scheldt, finding their left flank threatened, were not able to interrupt the retreat of the Belgian Army which continued its march westward without being seriously disturbed.

During the period of the Belgian retreat, the Germans redoubled their efforts against the defences of Antwerp. In view of the general situation the Military Governor of Antwerp decided at 5 p.m. on the 8th October that the 2nd (Belgian) Division and the British troops, except the Anglo-Belgian garrison of Fort 4 (of Inner Line South-East Defences) should follow the main Belgian Army and make an attempt to join up with it; these troops crossed the Scheldt the same evening by the bridges at Burght and Steen and, by 2 a.m. on the following morning, the whole of these troops were safely on the left bank of the river.

The Germans continued the bombardment of the city till about midday on the 9th October; previously to this the garrison of Fort 4 had evacuated this work and had crossed the Scheldt, destroying the bridges over the river as soon as they were safely across. Towards evening on the date last mentioned, the Germans entered Antwerp and, on the day following (10th October), the Military Governor capitulated.

On the morning of the 9th October, the main body of the Belgian

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Army was to the west of the Ghent-Terneuzen Canal, with rear guards to the east of this canal at Loochristy, Lokeren, Wachtebeke and Moerbeke, which had been left behind to cover the retreat of the 2nd (Belgian) Brigade and the British Marine Brigades which had left Antwerp on the 8th October.

The Belgian Army in falling back could make a stand on two defensive positions situated on its line of retreat; one of these being the Ghent-Terneuzen Canal prolonged by the Scheldt, and the other the Schipdonck Canal prolonged by the Lys. It had been hoped to make a stand on one at least of these positions, in order to secure the greater part of Flanders against invasion, should it be possible to join up with the Franco-British forces sent to the support of the Belgian Army.

But, at this time, the French left wing was at Arras, and the British Army had only just commenced its disembarkation from the trains which had conveyed it to the region of St. Omer. An attempt on the part of the Belgians to hold either of the two positions would, under the existing circumstances, have involved the serious risk of the right of the Belgian Army being turned by the large German force in Belgium and of its being forced back into Holland or driven helter-skelter on to the sea. The German troops were already on the march to the west and consisted, in addition to the troops which had been besieging Antwerp and several divisions of which were now available for employment elsewhere, of the new formations known as the XXII., XXIII., XXVI. and XXVII. Reserve Corps, which had just arrived in Belgium.

These considerations led to the decision being taken to continue the retreat to the Yser, there to join up with the Franco-British Armies. The Yser position possessed at that time considerable advantages. From the general point of view, it formed an extension of the Franco-British front, extending from Lassigny to Arras (a front of about 50 miles); it was an excellent position and one in which the Belgians could expect to hold out until the Franco-British forces joined up with them. The position was also good from the tactical point of view; its left flank rested on the sea, its front was covered by the river Yser, whilst its right flank was also protected by the same river. Further, the length of the line was not too great for the number of troops available for its defence; and the position offered the additional advantage, from the point of view of the *morale* of the Belgian troops, that it was situated wholly within their own country. Consequently, the Belgian Army took up its position on the line of the Yser.

On the 11th October, the Belgian troops left at Ghent, having accomplished the purpose for which they were originally sent there, were ordered to retire westward. The Germans again advanced to attack this place the same evening, but were checked by the 7th

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(British) Division which, however, retired later, keeping the enemy at a distance with artillery and rifle fire.

The Belgian cavalry covered the retirement and remained in contact with the enemy, fighting actions on the Ghent-Terneuzen Canal, on the Scheldt, the Schipdonck Canal and on the Lys. The 1st (Belgian) Cavalry Division then fell back towards the right of the Belgian Army after a fight at Lootenhulle; the 2nd (Belgian) Cavalry Division, consisting largely of divisional cavalry, fell back on Ursel, Bruges and the front held by the Belgian Army.

The occupation of the Yser position by the Belgian Army was completed on the 15th October, many difficulties having been overcome during the course of the retirement from Antwerp.

The Operations of the Western Allies: The Battle of the Yser.—In the fighting which had taken place since the beginning of the War the losses of the Belgians had been very heavy, so that when the Belgian Army reached the Yser its total strength had been reduced to 82,000 men, of whom 48,000 were infantry.

By the 15th October, the French front had been strongly established as far north as La Bassée. Since the end of September the Germans had made a continuous effort to outflank the left wing of the Franco-British Army. The German forces which had been engaged in the principal theatre of operations were, towards the middle of October, joined by the troops liberated by the fall of Antwerp and by the four corps of the new formation already referred to. To meet the great turning movement of the Germans, between La Bassée and Dunkirk, there were immediately available the remains of the Belgian Army, the 7th British Infantry Division, the 3rd British Cavalry Division, the French Brigade of Fusilier Marines and two French Territorial Divisions. The Belgian Army, to which was attached the French Brigade of Fusilier Marines, took up the position along the Yser from the sea to Zuydschoote. The 7th British Infantry Division and the 3rd British Cavalry Division took up a position in front of Ypres.

The defensive arrangements on these positions were soon completed. At this time, a British cavalry corps and the 2nd and 3rd British Army Corps had been completely transported to St. Omer, whilst at the same time the two French Territorial Divisions were advancing on Ypres and bodies of French cavalry were moving on Staden and also operating in the direction of Lille. The situation on the 17th October was as follows:—The 1st British Army Corps was still in process of transportation to St. Omer, the British Cavalry Corps and the 2nd and 3rd British Army Corps were in occupation of positions extending from La Bassée to the right of the position held by the 7th British Infantry Division on the line Zandvoorde-Gheluvelt-Zonnebeke; to the north of the last-mentioned position

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were British and French cavalry which maintained connection between the British and Belgian fronts.

Briefly then, the occupation by the Western Allies of a continuous front from the Argonne to the sea was an accomplished fact; although it was by no means sufficiently strongly held to prevent its being pierced by the very considerable German forces then ready to attack the Allied line. Measures were however being taken to strengthen the portion of the line north of the Lys, the 1st British Army Corps was expected to take up a position from Zonnebeke to Langemarck, on the 21st October, in extension of the left of the position occupied by the 7th British Division; the 42nd French Division was to join up on the Belgian front on the 23rd October; the 9th French Corps was to occupy a position east of Ypres on the 24th October, whilst the 16th French Corps was to take up a position south of Ypres on the 31st October. Time was still the essential consideration. The enemy's plans were soon disclosed—he intended to seize the line of the Yser from the sea to Dixmude and to break through the Belgian portion of the front with the object of turning the Franco-British left. The French General Staff requested the Belgians to hold on to their positions for 48 hours.

The position taken up by the Belgians from Nieuport-Bains to Boesinghe was 22½ miles; Dixmude was centrally situated on this line. The Yser, which lay in front of this position, has a width of about 22 yards, and is provided with embankments on both banks; the embankment on the west bank having a command of some 6 ft. over that on the east bank. The river makes a loop, known as the "Tervaete Loop," about half-way between Nieuport and Dixmude, the salient of which projects eastward and thus formed a weak point in the Belgian defence line. The whole region is much intersected by canals, ditches and rivers; eight bridges spanned the portion of the river under consideration. Another feature of importance in this region was the railway from Nieuport to Dixmude; it is constructed on an embankment having a command of from 3 to 6 ft. over the surrounding plain. Six canals and water courses flow into the sea at Nieuport, they are provided with sluices by means of which the region of the Yser can be flooded at high water.

The 2nd (Belgian) Division held the left of the line resting on the sea, and the remaining troops were extended from their right in the following order:—1st (Belgian) Division, 4th (Belgian) Division, the French Fusilier Marines, the 11th and 12th (Belgian) Regiments of the Line, two brigades of field artillery belonging to 3rd (Belgian) Division, the 5th (Belgian) Division, and the 6th (Belgian) Division.

The French troops and the artillery mentioned above held a bridgehead at Dixmude covering the railways to Nieuport and Furnes. The 6th (Belgian) Division had French Territorials on their right south of Boesinghe.

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The 3rd (Belgian) Division had two brigades in reserve at Lampernisse. The 1st (Belgian) Cavalry Division covered the Belgian right flank and acted in co-operation with French cavalry in the direction of Roulers; the 2nd (Belgian) Cavalry Division was in reserve between Nieuport and Furnes. The only troops in reserve, behind the front of 22½ miles referred to above, were the two infantry brigades and the cavalry division above mentioned.

The Germans reached the Yser position on the 16th October and made a reconnaissance in force towards Dixmude the same day. On the following day, the presence of considerable bodies of German troops was reported towards the north of the Belgian position, indicating that the enemy intended marching against the front Nieuport-Dixmude; later in the day German artillery came into action at Slype and bombarded Rattevalle. It was decided to reinforce the portion of the Belgian front most immediately threatened, in consequence the 5th (Belgian) Division was withdrawn from the right of the Belgian line and located at Lampernisse and the 3rd (Belgian) Division was moved to Avecapelle. The gap in the line created by the withdrawal of the 5th (Belgian) Division was filled by a brigade from the 6th (Belgian) Division, moved into the line from Noordschoote.

The German attack on the Belgian advanced posts commenced on the 18th October; the Germans obtained a passing success at Mannekensvere opposite Nieuport. The British Navy came to the assistance of the Belgians and bombarded the German troops on the coast between Nieuport and Middelkerke; this support and that given by the French troops on the Belgian left was much appreciated.

It was felt that the Franco-British Cavalry Force operating in the direction of Roulers sufficiently protected the right of the Belgian line, and in consequence the 6th (Belgian) Division was moved to Lampernisse as a reserve, the 5th (Belgian) Division now taking post at Oostkerke and the 3rd (Belgian) Division at Wulpen for a similar purpose. French Territorials took up the positions vacated by the 6th (Belgian) Division, and the 1st (Belgian) Cavalry Division joined up with the French cavalry and were ordered to maintain close touch with the right of the Belgian troops.

On the 19th October, the Germans attacked the Belgian left and centre and captured the advanced positions from Lombaertzijde (about 1 mile north of Nieuport) to Beerst (about 2 miles north-north-east of Dixmude), a front of about 8½ miles.

The 6th (Belgian) Division received orders to entrench itself at Pervyse (on the railway about midway between Nieuport and Dixmude), and, at the same time, to ease the position on the Belgian left and centre a counter-offensive against the German left was decided upon. The 5th (Belgian) Division was ordered against

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Vladsloo (about 2 miles north-east of Dixmude); the French Fusilier Marines were sent against Beerst whilst the 11th and 12th (Belgian) Regiments of the Line were to hold the bridgehead at Dixmude.

This counter-offensive had been launched and Beerst and Vladsloo had already been occupied by the Allies, when reports were received to the effect that strong bodies of German troops of all arms had pushed through north and south of Roulers and that the Franco-British cavalry was retiring from Roulers. In consequence, the position of the French Fusilier Marines and the 5th (Belgian) Division, on the right bank of the Yser, appeared too exposed and these troops were recalled to the left bank of the river.

On the 20th October, an intense bombardment took place of the whole Belgian front and a double attack was also delivered by the Germans against both the flanks of the Belgian position. The Belgians in consequence were compelled to yield more ground, particularly on their left, but in the neighbourhood of Dixmude they repulsed the German attack.

By the 21st October, the Germans had completed their concentration; the 4th Ersatz Division was opposite Nieuport, the III. Reserve Corps was on the front Nieuport to Keyem (about 3½ miles north-north-east of Dixmude), the XXII. Reserve Corps was to the north of Dixmude, the XXIII. Reserve Corps opposite Dixmude and to the south of this place; the German forces totalled thus seven divisions. The Belgian and French General Staffs now agreed that the Belgian Army should be concentrated on a narrower front than that occupied by it, and the position from Nieuport to St. Jacques-Capelle (about 2 miles south-west of Dixmude) that is to say, a front of 12½ miles was assigned to it, the remainder of the position southwards being taken over by French troops.

During the night of 20th—21st October and also during the whole of the 21st October a violent artillery fire was directed against the Belgian position and did much damage. There was scarcely any fighting on the part of the infantry.

By the evening of the 21st October, the position of the Belgian Army had become critical; the greater part of the reserves had already been used up.

During the night of 21st—22nd October, matters took a serious turn; taking advantage of the darkness of the night the Germans had seized a temporary bridge at Tervaete and crossed over to the left bank of the river. The Belgians tried to drive them back and several counter-attacks were launched for the purpose, but without success. The Belgian casualties were heavy, and the troops holding this part of the line had to fall back; in consequence, the enemy was able firmly to establish himself in the positions gained. However, the Belgian artillery poured a continuous rain of shell on the Tervaete Loop in order to render the German position untenable and

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so as to prevent the construction of bridges across the river. At other points along the river the German attempts to cross had been defeated and in front of Nieuport the Belgians even gained some ground.

On the 23rd October, the 42nd (French) Division arrived on the scene and was pushed to Nieuport for a counter-attack on the German right. The position of the Belgian centre opposite the Tervaete Loop soon became exceedingly critical owing to the fact that German troops were being massed against it in very great strength. During the night 23rd—24th October, the Belgians again gave ground, but were ordered to hold on at all costs to the chord of the Tervaete Loop. However, their losses were so heavy that their commander in this region reported: "The troops are worn out, their *morale* is lowered and they consequently may be seized by panic at a trifling incident." The brigade commander at Dixmude also reported that his troops were tired out. The Belgian General Staff, recognizing that the situation at the Tervaete Loop was extremely serious, asked the French commandant in this region in express terms for support at the Belgian centre, stating: "An energetic counterstroke of as great a number possible of the troops of the 42nd Division (engaged near Nieuport) may yet re-establish our position." The French commandant responded by sending one brigade of the 42nd (French) Division as requested; it came into action at daybreak on the morning of the 24th October. During this day, the German pressure on the Belgian line was so great that the Belgians had again to yield ground falling back to the line of the Beverdijk. A French counter-attack failed to drive back the enemy.

The Germans now made a supreme effort against Dixmude. During the night of 23rd—24th October, they delivered 15 distinct attacks, but were held at bay by the French and Belgian troops at this point. The German attacks were renewed during the day, and they captured the trenches at the bridge, only to be driven therefrom later. In one case a Belgian battalion was fighting continuously for 72 hours in its trenches, and in two other cases Belgian troops were engaged continuously for 43 hours.

In view of the situation referred to above, a further representation was made to the commander of the French troops at Nieuport regarding the position of affairs at the Belgian centre and, in consequence, practically the whole of the 42nd (French) Division was moved from the left flank to support the Belgian centre.

On the 25th October, the German attack slackened which appeared to indicate that the German troops were worn out; however, they were able to check a counter-attack made against their left flank at Oud-Stuyvekenskerke by a French brigade and the 5th (Belgian) Division. On the evening of this day the Belgians were still in

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possession of the position taken up on the Noord-Vaart and the Beverdyk; they also held Oud-Stuyvekenskerke, a part of the embankment on the Yser in the neighbourhood of the 15-kilometre milestone, also the bridgeheads at Nieuport and Dixmude. Advantage was taken of the relative calm to reorganize the Belgian troops and to sort them out into their proper units. During this day the Belgian General Staff went into the question of withdrawing the Belgian troops to the line of the Nieuport-Dixmude railway and of flooding the country to the eastward of this railway up to the Yser.

By the 26th October, the Belgian artillery had suffered considerable losses and it had but 100 rounds a-piece left for the guns still in action. The Belgian infantry was also so exhausted that, in some cases, the men were not able to hold out any longer against the German attacks and therefore retired before the German advance, temporarily surrendering possession of the railway at some points. The Belgian troops at Dixmude had a particularly trying time, fortunately two Senegalese battalions arrived most opportunely and saved the situation. In the evening, the two Belgian Cavalry Divisions were told off to guard the bridges over the canal between Furnes and Loo.

The enemy showed little real activity on the 27th and 28th October and advantage was taken of the lull to withdraw the remnants of the 3rd and 6th (Belgian) Divisions from the firing line and to form them into a sort of reserve. The preparations made for inundating the country eastward of the railway being complete, the sluices were opened on the 28th October and the country in front of the position held by the 2nd (Belgian) Division was flooded. On the day following, the Germans were again very active and subjected the position held by the 1st, 2nd and 4th (Belgian) Divisions to a violent artillery bombardment. On this day, the inundations began to extend southwards.

On the 30th October, the Germans pressed their attacks on the Belgian left and centre; they were repulsed at all points, except at Ramscappelle (about 1½ miles south of Nieuport) where the enemy bombed the Belgians out of their trenches and thus succeeded in gaining a footing on the railway. However, during the afternoon and evening of this day, a counter-attack was delivered by Belgian and French troops who forced the Germans back from the railway and reoccupied the railway Halt at Ramscappelle.

The inundations now commenced to spread over the whole region prepared for this purpose and the Germans were no longer able to remain in occupation of the trenches between the railway and the Yser. Thus ended the Battle of the Yser.

Soon the Germans were in possession of a few strong points alone on the left bank of the river; they retired leaving behind them their wounded, rifles, guns and ammunition.

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The Belgian losses were considerable, being estimated at 14,000 killed and wounded. The Belgian infantry was reduced to 32,000 rifles, and more than one-half the guns of the Belgian artillery were out of action.

The heroic resistance of the Belgian Army had resulted in breaking up the attack of seven German Divisions which suffered considerable losses and were put *hors de combat* for some time to come. The important thing however was that time had been gained and, in the meantime, the Franco-British defences to the south of the Yser had been strengthened, and particularly those near Ypres.

During the two succeeding months the operations on the Yser front resolved themselves into sporadic advances and retreats. At the end of 1914, the Germans had been practically driven from the left bank of the Yser ; they had only some listening and observation posts left in their hands on this bank of the river, the inundations having so completely effected their purpose.

General Review.—The ninth chapter concludes the Report with a general review of the operations. It is pointed out that during the night of the 3rd—4th August, that is a little more than 24 hours after the delivery of the German Note to the Belgian Foreign Minister, reliable information having been received that German troops were about to invade Belgium, the Belgian troops took up positions with the object of ensuring respect for the neutrality of the little kingdom ; one division was told off to observe the territory which might be threatened by a British invasion, two divisions the frontier likely to be threatened by France and a fourth division the frontier actually threatened by Germany.

The Belgian plans were drawn up with the main object of covering as large a tract as possible of Belgium against invasion and, in order to secure this object, it was intended that the Belgian Army should act in concert with the forces of those Powers who were ready to act in strict accordance with their treaty obligations in relation to the protection of the neutrality of Belgium. It was not till the Belgian Army had gained the line of the Yser was it able to act on a concerted plan of joint operations ; by this time, practically the whole of Belgium had already been invaded.

By taking up a succession of defensive positions, from that of the Gette in mid-August to that on the Yser in mid-October, the Belgian Field Army had managed to hold itself together in face of far superior German forces and from the time that the Yser was occupied, during the two and a-half months of fighting which ensued, the only losses which the Belgians suffered were the actual casualties taking place on the field of battle ; no organized unit fell into German hands as prisoners during the period referred to.

Between the 22nd August and 25th September, the Belgian Army, besieged in Antwerp, had by its sorties effectively co-operated in

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improving the strategical situation for the Western Allies; these sorties had resulted in the Germans retaining before Antwerp forces superior in number to those defending this entrenched camp.

After a retreat of 87½ miles from Antwerp, a junction was finally made by the Belgian Army with the forces of the Allies; this Belgian Army, with the assistance of a French Division, broke up the offensive of a German Army of 150,000 men.

The Belgian General Staff had, in accordance with the Treaty obligations imposed upon their country, made preparations for the defence of the fortresses of Liège, Namur, and Antwerp, but the enormously powerful artillery possessed by the invaders made a long resistance at these centres impossible.

From whatever point of view the events of the latter half of 1914 are looked at, Belgium at least has the proud satisfaction of knowing that her King and Government have most scrupulously fulfilled every obligation accepted by the little kingdom under Treaties and otherwise; and further, that it was due largely to the valour of her Army that the situation in Western Europe was saved during the most critical days of the German invasion.

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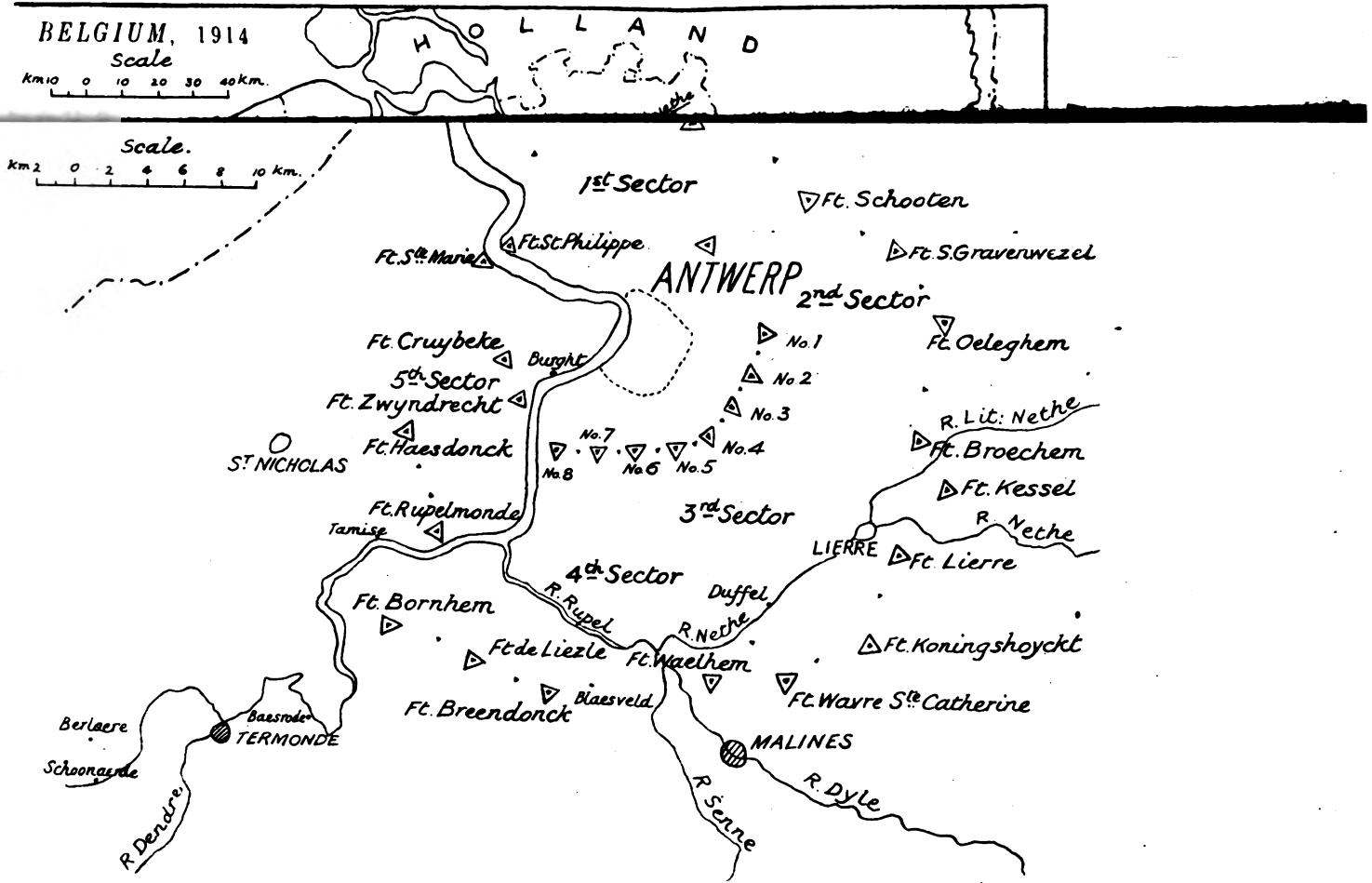

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IMPROVEMENTS IN CAMP EQUIPMENT.

By 2ND LIEUT. E. J. MCKAIG, R.E. (T.F.), A.M.I.C.E.

IN the September issue of the *R.E. Journal,* various details of camp arrangements were given, that claimed certain improvements and in most cases economy in construction. Here a field cooking range, or complete field kitchen, is described and as before the illustrations are intended to show the type and general arrangement only and are not working drawings.

There are at present many different camp ovens and cooking arrangements, each possessing its own particular advantages, but the rule is invariably to have separate fires for the oven and kitchen. In the system of cooking described here the aim is to utilize the same fire for both purposes, effecting an economy in fuel and altogether a better working arrangement. As will be seen by the accompanying figures, there is no novelty about any part, the originality being in their combination.

Fig. 1 is an iron grid, 6 ft. long, suggested as a standard length, sufficient to accommodate six 12-quart kettles, but the length is not important. This grid is laid upon the ground shown dotted in *Fig.* 2 over the ordinary 9-in. trench. The oven (*Fig.* 3) of sheet iron is placed at the end, and the kettles close together upon the grid (*Fig.* 4) forming practically a closed flue connected with the chamber under the oven and the chimney. In *Fig.* 2 two trenches only are shown, at right angles. There is no reason for this, it would be better to have three or more, at any convenient angle, a clear way being left for access to the oven door, in which case one could always be used for stopping-off to suit varying winds and improving the draught.

In actual practice the oven may be covered with clay in the same manner as the "Aldershot" and other field ovens are invariably treated, and a small bank of clay along the sides of the kettles might be an advantage. In some positions where trench digging is inconvenient, the grids and ovens can be placed upon sod, brick or clay walls, built up to give the required fire space, but either method makes a good kitchen and the loss of heat is reduced to a minimum, and a great saving of fuel is effected. An addition from a sanitary point of view is brought about by a path of sanitary slabs (see *R.E. Journal,* September), laid at the oven door and along one side of each trench.

In place of the oven a water boiler can be substituted, one of simple construction similar to the oven, but having a central flue. It is suggested that the grids and ovens are made an article of store and of standard size, *e.g.* (say three 6-ft. grids and one oven make a

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kitchen for a given number of men) and duplicated as required. The oven is made collapsible, so that with the flat grids transport would be easy.

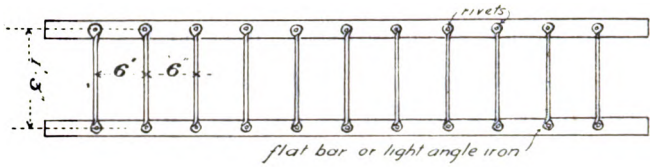

FIG. 1.

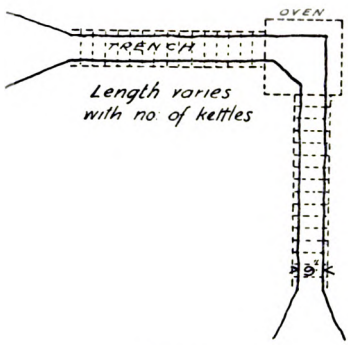

FIG. 2.

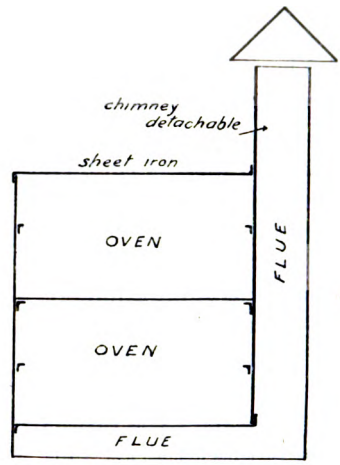

FIG. 3.

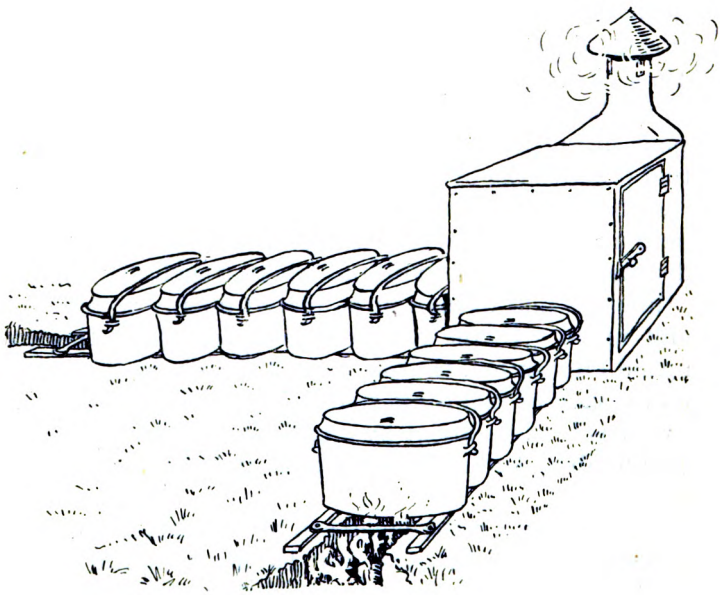

FIG. 4.

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SIEGES AND THE DEFENCE OF FORTIFIED PLACES BY THE BRITISH AND INDIAN ARMIES IN THE XIXth CENTURY.

(*Continued*).

By COLONEL SIR EDWARD T. THACKERAY, V.C., K.C.B. (LATE R.E.).

THE WAR WITH CHINA, 1860. CAPTURE OF PEKIN.

The cause of this war appears to have been the unwillingness of the Chinese Government to ratify the Treaty of Tientsin, which, according to the provisions of that agreement, should have been completed on or before 26th June, 1859.

On 17th June, Admiral Hope, Commander-in-Chief of H.M.'s Naval Forces in the Eastern seas, appeared at the mouth of the Peiho to announce the approach of the English and French Ministers. The Admiral was told that the passage had been closed by the Militia without the orders of their Government. These untrue representations were supported by false appearances; the batteries of the forts were masked, no banners were displayed, and no soldier was seen. No communication was allowed with the shore. After promising to remove the obstacles at the mouth of the river the Militia repudiated the promise.

Such was the state of affairs when the British Minister, the Hon. F. Bruce, arrived outside the bar on 20th June. Finding that the Chinese officials kept aloof, while the Militia continued to assert that the obstruction was their own unauthorized act, he called upon the Admiral to take such steps as were necessary to reach the capital by the time appointed. This, on the 25th June, the Admiral was proceeding to effect, when the forts, which for eight days previous had appeared deserted, suddenly opened fire on the squadron, the result being that it was repulsed, and obliged to abandon some ships, guns, and *matériel*.

The British and French Governments then entered into a treaty to enforce the Treaty of Tientsin, by force of arms if necessary; and it was agreed that 10,000 English and 7,000 French should be sent to China. Lieut.-General Sir Hope Grant was placed at the head of the *corps d'armée* of two divisions, and Major-General Sir Robert Napier, R.E., commanded the 2nd Division. The French Army had to be despatched from France, the British came chiefly from India. The former assembled at Shanghai, the latter at

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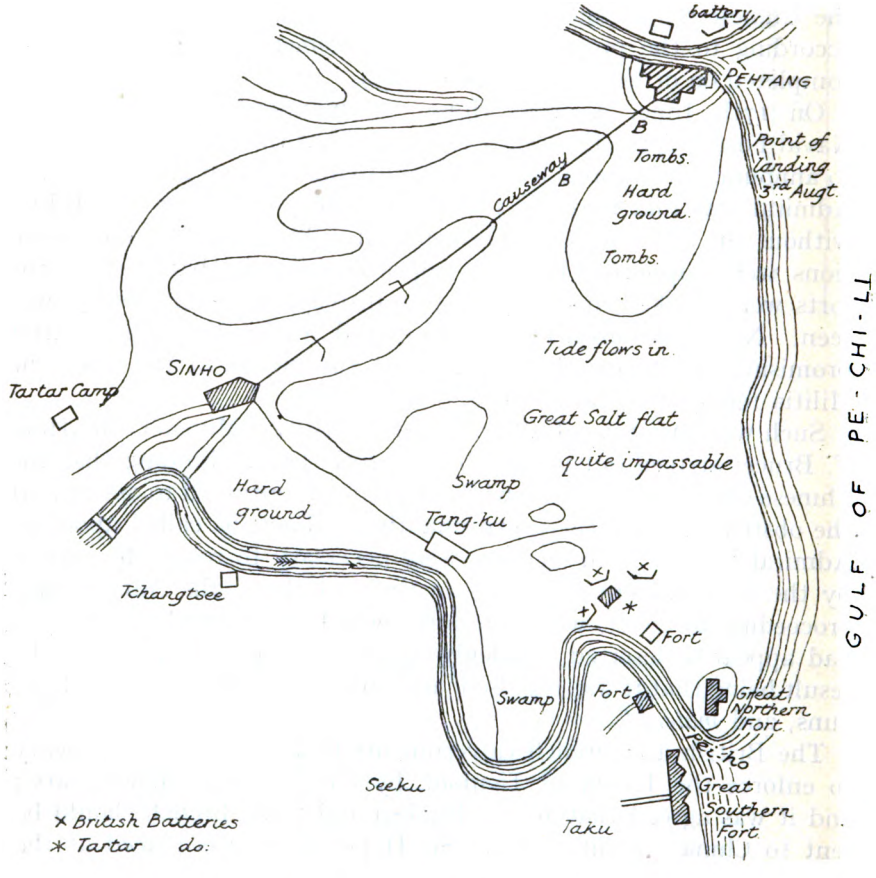
Hong Kong, and the British were ready for action by the middle of June. The French were not so forward with their arrangements, and fixed the 25th July as the earliest date on which they could assume offensive operations.

On the 1st August the 2nd Brigade, 1st Division, supported by the French, had landed at Pehtang, a large village situated on a river of the same name, 10 miles north of the Peiho. They experienced great difficulty in getting through the mud, and passed the night on the mud-flats. The 2nd Division remained on board the ships. The forts looked formidable, but no serious opposition was offered to the disembarkation; the chief difficulty was the mud.

SKETCH OF PEHTANG
AND
the Taku Forts.



In the morning the forts and town were taken possession of. The Chinese, before withdrawing, had buried large shells with trains with spring-locks, so as to cause an explosion should the latter be acci-

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dentally pressed by the foot. Warning was, however, received in time to prevent damage. On the 3rd August the troops had a skirmish with the Tartars in which Major Greathed, R.E., was wounded.

By the 7th August all the troops had landed. The quarters allotted to the Sappers were found full of putrid matter, the Chinese having killed their animals prior to abandoning the town, and distributed parts of them over the different houses, doubtless with a view to cause a pestilence among the invaders. After making the houses habitable, the Sappers were employed in making a road through the marshes which surrounded Pehtang, and which had been rendered very difficult by heavy rain, so as to facilitate the transit of the heavy guns and baggage to the main embanked road, which led to the entrenchments in front and to the Taku Forts.

On the 9th Capt. Wolseley (afterwards Field Marshal Viscount Wolseley, O.M., G.C.B., G.C.M.G., etc., etc.) reconnoitred to the right by which the enemy's left might be turned. He ascertained that the country in that direction was practicable for all arms.

The allied force left Pehtang on 12th August, and marched in the direction of Sinho, a large village on the Peiho, about 8 miles from its mouth, the Tartars being known to occupy a strongly entrenched position on the lines of march. The 2nd Division went in advance, by the route to the right, to take the entrenched camp in flank. The 1st Division, and the French force moved along the causeway. On approaching the entrenchment, a large force of Tartar cavalry came out and hovered about our flank to charge but without effecting it. Upon one occasion the brigade to which the Sappers were attached was halted, and formed into squares to receive them ; but our fire kept them most effectually at a distance.

Notwithstanding the work of the Sappers, the marsh was so bad that the horses stuck, the guns sank up to their axles, and it was found absolutely necessary to leave behind many of the waggons. The start had been made at 2.30 a.m. and after many hours of hard work struggling against these difficulties, the guns were dragged through about 2 miles of marsh, and eventually landed on hard ground at 10 a.m., when the troops were halted, the enemy being known to be close in advance. After a short rest, the advance was ordered, and the Tartars were soon discovered. In spite of some gallant attempts at charges on their part, they had to retire and leave the Allies in possession of the entrenchment at Sinho ; and the army bivouacked there for the night.

Next day the force moved to the east of Sinho, within 2 miles of the fortified town of Tang-koo. An Engineer Brigade was then formed under the orders of Lieut.-Colonel Mann, commanding R.E. It consisted of the 10th and 23rd Companies, R.E., half of the 8th Company, with A and K Companies of the Madras Sappers.

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On the night of the 13th a working party, consisting of details of R.E., and Madras Sappers, and a strong body from the Line, were sent in the direction of Tang-koo, for the purpose of throwing up cover for the riflemen. After reconnoitring the fort closely, the party was set to work, and by daybreak a good line of cover had been thrown up about 400 yards from the fort.

About 6 a.m., the 1st Division advanced to the attack, the English on the right close to the Peiho, while the French attacked the gateway. A strong body of Artillery and Engineers accompanied the force. Among the latter were parties of Madras Sappers, with scaling ladders and powder bags, Lieut. Filgate being in charge of the former, and Lieut. Swanston of the latter. The Artillery opened fire at a distance of 1,500 yards, and gradually approaching the fort, silenced the Tartar fire after a sharp cannonade of three hours. The pontoons and scaling ladders were then called for; but before they reached the ditch, a few riflemen had crept round the work close to the river, and found that the Tartars had fled and were crossing to the south side as fast as they could. Twenty-four guns were taken in the fort. The capture of Tang-koo left us in a very strong position in rear of the Peiho Forts.

The following days were occupied in reconnoitring, and on the 17th the Commander-in-Chief, Sir Hope Grant, determined that the fort to the north of the Peiho should be first attacked. It was nearly square in shape, each side measuring 150 to 200 yards. In the centre was an immense tower of solid earth, on which were mounted three very large brass guns. The whole of the fort was strongly defended by smaller batteries.

The enemy had lost no time in strengthening the land defences; all their heavy guns had been turned round, the parapet had been raised and strengthened with enormous piles, and fresh embrasures and loopholes had been cut. But it was in what may be called its "passive" defences that the fort especially excelled. Throughout a circuit of about a mile the country was intersected by numerous canals and deep ditches, running in every direction. The fort itself was surrounded by three wet ditches, the outer one broad and shallow, and the two inner ones varying in breadth from 20 to 25 ft., and 4 to 8 ft. in depth; the intervening spaces, as well as the berm, were protected by very strong abattis, and by masses of sharp-pointed stones, and bamboo spikes, firmly rooted to the ground.

All were agreed that few places of the kind have ever been more perfectly supplied with obstacles of this nature. Nothing seems to have been neglected. *Trous de loup*, crows' feet, and strong iron spikes were scattered in abundance to impede our progress, while the garrison was defended against night surprises by alarm bells, which anyone attempting to cross the abattis must inevitably sound.

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The 18th and 19th August were taken up in preparing small bridges to carry the artillery over the canals and ditches. At 5.30 p.m., on the 19th, a party started to place these bridges in position. The Sappers who were employed on this work were under the orders of Lieuts. Du Cane and Filgate. They returned at 8 a.m. on the 20th having effected their purpose, besides making two dams to shut off the supply of water from the canals.

On the afternoon of the same day, Lieuts. Hime, R.E., and Trail, R.(M.).E., were directed to trace five batteries in positions which had been fixed after the reconnaissance and personal inspection of Sir Robert Napier. This duty was carried out without much opposition from the forts. When night closed in, all the available men of the Madras Sappers were marched out to complete the necessary works before daylight, by which time it was intended that the guns should be in position and ready to open fire. This intention was successfully carried out, and the Tartars did not notice that the English were in position till 4.30 a.m., on the 21st, when they opened fire.

The elevation of the enemy's fire was fortunately too great, and, as by their arrangements they could not readily be altered, their fire did comparatively little harm. Our guns at once returned the enemy's fire, and a very heavy cannonade was kept up for about four hours, when the Taku Fort was somewhat silenced. The 44th and 67th Regiments were pushed forward as skirmishers, followed by the Sappers, etc., with pontoons and ladders. There was some delay in crossing the ditch, owing to the size and weight of the pontoons, and during this slight halt our troops suffered severely from the heavy cross-fire.

The Sappers accompanying the storming party were divided into four subdivisions; the pontoon party under Lieut. Pritchard, R.E. (afterwards Lieut.-General Sir Gordon Pritchard, K.C.B., Colonel Commandant, R.E.); the ladder party under Lieut. Hime, R.E.; the detachment for removing obstacles under Lieut. Trail; and the powder bags under Lieut. Clements, R.E. Once over the ditch, the scaling party were not long in effecting a lodgment in the work, despite the fierce attempts of the Tartars to dislodge them. Lieut. Trail was with the ladder party, and was among the first of those who entered the fort. Lieut. Filgate, with a party of Sappers, was highly praised for the rapidity with which, under a heavy fire, he made a causeway for heavy artillery across a canal close to the fort. The escalade was greatly facilitated by the Chinese coolies from the south; who rushing into the ditch, and throwing ladders across their shoulders, formed a temporary bridge, over which the assailants passed. Many of the coolies were wounded, but instead of retiring to the rear, they took up their position behind the first mound which offered the slightest shelter, and thence viewed the attack going on in front. In the afternoon an advance was made against a second

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fort. We were allowed to take possession of it without opposition, and one after another the remaining forts capitulated.

This was a very fortunate circumstance, as almost immediately after heavy rain came on, which so saturated the mud, that moving the guns would have been a task of a very serious nature in the face of the enemy. During the 22nd and 23rd, all the forts on the south side of the river were evacuated and surrendered to the Allies.

It was now thought that the campaign was finished. The 1st Division moved up to Tientsin on the 30th, and the 2nd followed on 1st September. On the advance of the expedition towards Tientsin, orders were given for the demolition of the forts on the south side of the river, while the French undertook the destruction of those on the north.

In accordance with these instructions, the Wasp and Artillery Forts were completely destroyed, and the mining of the South Fort proceeded with until stopped by the conclusion of peace at Pekin. Owing to the unexpected interruption of the negotiations at Tientsin, a large part of the force then at that place was ordered to march in the direction of Pekin. The army marched by Poo-kow, Yang-tsin, and Hose-woo, which last place it reached on the 13th.

On the 14th, a mission, consisting of Messrs. Parkes, Lock and a small escort started for Tung-chow. The army moved forward on the 18th. Although carrying a flag of truce, Messrs. Parkes, Lock, and their whole party were taken prisoners, and most shamefully treated. Many of these were cruelly tortured to death. On the 18th, was fought the Battle of Chang-kia-wan, when the enemy were signally defeated, and driven back with great loss on Tung-chow.

Tung-chow was occupied, and the army remained there till the 21st. All this time negotiations were going on with the object, if possible, of rescuing the prisoners in the hands of the Chinese, who were then imprisoned at Pekin. These failed, and at last it was decided that force must be employed. The Engineer operations and the subsequent destruction of the Summer Palace were thus described by Capt. C. G. Gordon (afterwards General Gordon, the hero of Khartoum) in one of his letters :—

"On the 11th October we were sent down in a great hurry to throw up works and batteries against the town, as the Chinese refused to give up the gate we required them to surrender before we would treat with them. They were also required to give up all the prisoners. . . .

"To go back to the work, the Chinese were given until 12 on the 13th to give up the gate. We made a lot of batteries and everything was ready for the assault of the wall which is battlemented and 40 ft. high, but of inferior masonry. At 11.30 p.m., however, the gate was opened and we took possession so our work was of no avail. . . .

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"Owing to the ill-treatment the prisoners experienced at the Summer Palace the General ordered it to be destroyed, and stuck up proclamations to say why it was ordered. We accordingly went out, and after pillaging it burned the whole place, destroying in a vandal-like manner most valuable property which could not be replaced for four millions. . . . Quantities of gold ornaments were burned, considered as brass. It was wretchedly demoralizing work for an army. Everybody was wild for plunder. You could scarcely conceive the magnificence of this residence, or the tremendous devastation the French have committed. The throne and rooms were lined with ebony carved in a marvellous way; there were huge mirrors of all shapes and sizes, clocks, watches, musical boxes with puppets on them, magnificent china of every description, heaps and heaps of silks of all colours, embroidery, and as much splendour and civilization as you would see at Windsor; carved ivory screens, coral screens, large amounts of treasure, etc. The French have smashed everything in the most wanton manner. It was a scene of utter destruction which passes my description."

On the 12th and 13th Messrs Parkes and Lock, with a French officer and a Sikh duffadar were released; a few more Sikhs and French were subsequently sent in, and the Mandarins then stated that no more of the prisoners remained alive. They afterwards sent in the bodies of all who had been murdered, with the exception of two, Capt. Brabazon and the Abbé de Luc, who had been beheaded at the bridge of Pa-li-chow, having met the Tartar Army on its retreat on 21st September. The bodies of the murdered prisoners were buried on the 17th with great solemnity.*

Lord Elgin's terms were that 300,000 taels should be handed over by the 22nd October to be distributed among those who had suffered and the families of those who had been murdered. He notified also that it was intended at once to utterly destroy all that remained of Yuen-ming-yuen, within the precincts of which several of the British captives had been subjected to the grossest indignities. Before the 20th Prince Kung was to inform Lord Elgin that he was willing to sign the convention.

On the 18th October the 1st Division, under Sir John Michel, marched on Yuen-ming-yuen, and set fire to all the palaces. On the 19th the fires were still burning, and the wind carried the smoke over our camp right into the city. By the evening the summer palaces had ceased to exist. On the 20th Lord Elgin received Prince Kung's absolute submission. On the 24th the convention was

* Prisoners returned safe—Messrs. Parkes and Lock, Monsieur L'Escoyrac de Lauture, 11 Sikh soldiers, 5 French soldiers; total, 19. Prisoners murdered—Lieut. Anderson, Mr. de Norman, Phipps, K.D.G., Mr. Bowlby (*Times* Correspondent), Capt. Brabazon, R.A., Abbé de Luc, 4 French officers and soldiers, 10 Sikhs; total, 20.

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signed by Lord Elgin and Prince Kung (brother to the Emperor). Sir Hope Grant was present at the proceedings, while Sir Robert Napier had charge of the military arrangements connected with them. The French convention was signed next day. Both treaties were afterwards sent to Gehok, where they received the Emperor's signature.

The position selected for our breaching batteries is a point of interest worthy of record. It was about 600 yards to the east of the Au-ting Gate. The guns were to be placed within the high wall which surrounded the Te-tsu or Temple of the Earth. Four 8-in. guns were to make a breach between the second and third square flanking towers east of the gate. Two Armstrong 12-pounders were to play upon the breach, whilst two others fired down the road leading to the gate, two more to be in reserve. A battery of 9-pounders to counter-batter. Our mortars to play on the breach. Our guns were placed on wooden platforms laid down behind the massive brick wall of the Temple. The French had no regular breaching guns, but they hoped to make their heaviest field battery serve instead. Their battery was to our left and only 60 yards from the walls. Ours was 200 yards. Shelter was dug in advance for our infantry, so that the Chinese gunners and the breach should be well plied with rifle fire.

Nothing now remained for the army to do in the north, and the march to the south shortly commenced. The weather in the latter part of the campaign was extremely cold and trying to the troops, especially the natives of India. On the march from Pekin the thermometer at night was often below 20 degrees Fahrenheit.

Sir Hope Grant in a letter to the Viceroy, dated 21st November, 1860, thus writes :—" The two companies of Madras Artillery under Capt. Hicks, and the two companies of Madras Sappers under Capt. Shaw-Stewart rendered good and useful service in the operation which preceded and led to the fall of the Taku Forts. The latter corps was most energetic in working without reliefs at the construction of the batteries. . . ."

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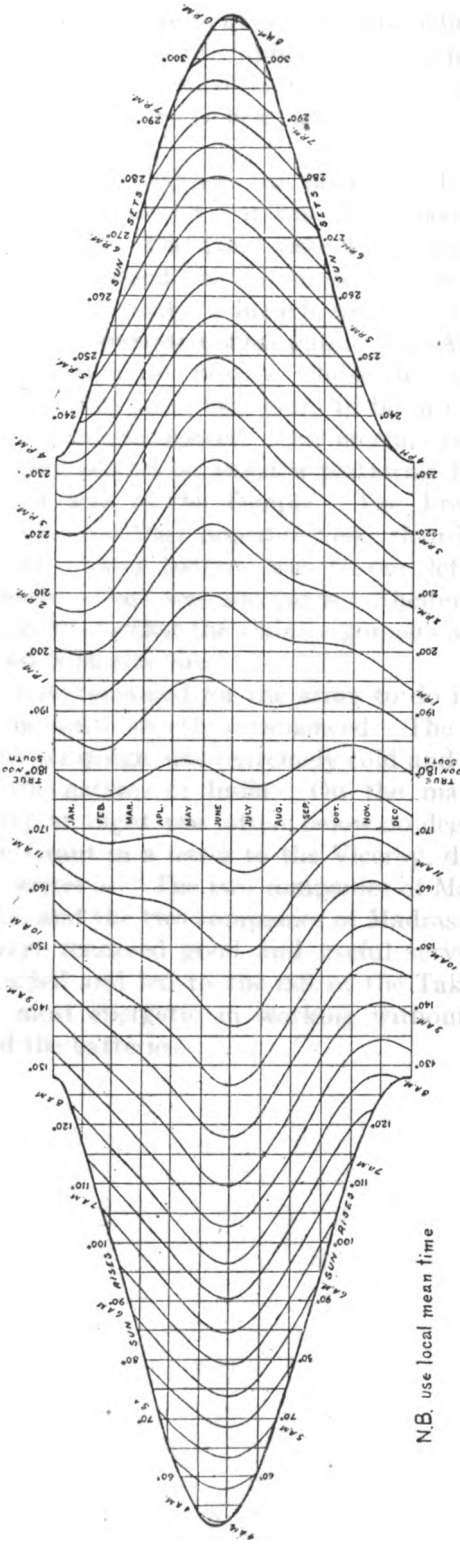
SUN-BEARING DIAGRAM.



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SUN-BEARING DIAGRAM.

By CAPT. JAS. MCEVOY, Canadian Engineers.

THE object of the Sun-Bearing Diagram is to enable a compass to be checked for any unusual local attraction. It is particularly intended for use in places where iron tools or munitions might so affect the compass that the results of an attempted survey might be very misleading.

The hour lines drawn upon the diagram are for local mean time, thus doing away with the necessity for an almanac giving the equation of time. While the hour lines are only drawn for every half hour and the sun's azimuth or sun-bearing lines (the straight vertical lines) are drawn only for every 5 degrees, a careful reading by the eye alone will enable the compass to be tested at least half degrees and a trained eye can be depended upon to get results as close as one quarter degree.

The calculations for the diagram were made for the meridian of Greenwich, but there is no appreciable error for any meridian in Europe. Naturally in order to get the true local time if Greenwich time is used in the field 4 minutes must be added to, or subtracted from, the Greenwich time for every degree of longitude the observer is east or west of Greenwich.

The lines drawn to show the rising and setting of the sun may be used to obtain the local mean time, as these lines also have been drawn so as to do away with the necessity of taking the equation of time into account.

The diagram submitted is calculated for Latitude 50° north, but it can be used for one-half a degree either north or south of that latitude without serious error.

The idea and work of calculation and drawing is original with the writer. The diagram has never been subjected to a critical examination test, but is submitted in the hope that it will fill a want which the writer has many times felt in civil life when working in places badly affected by local attraction. Naturally similar diagrams can be made for any other degrees of latitude.

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NOTICE OF MAGAZINE.

RIVISTA DI ARTIGLIERIA E GENIO.

May, 1915.

ON THE VALUE OF PERMANENT FORTIFICATIONS.

Two articles are published in the first number of the *Kriegstechnische Zeitschrift*, 1915, which contain new ideas on fortification and attack. The first is by Frobenius, the other by an anonymous writer.

Frobenius writes: Military engineers should rejoice at the advent of the new very powerful siege artillery, the mortars of 30·5 and of 42 cm., because they know at length with certainty what kind of enemy they have to deal with, while in the past they were constrained to act in doubt. They have always felt suspended over their heads the sword of Damocles, representing the possibility of an entrance on the scene of the most powerful artillery. Now, however, they are able to measure the efficacy of a single shot of siege artillery, and since everything human has a limit it may be retained that the powers of artillery cannot be extended much further, so that the military engineer finds himself facing a well-defined problem.

The fortifications on the northern frontiers of France and Belgium may be subdivided into three groups: those which like Liège, Charlemont, Les Ayelles, Hirson, Longwy, etc., fell after a very short siege; others as Lille, Laon, La Fère and Reims were evacuated on the advance of the German armies; while Namur, Maubeuge, Antwerp were compelled to surrender in 10 or 12 days.

With regard to the first group it may confidently be affirmed that the non-success of the defence may be attributed to the superiority of the attacking artillery who succeeded in occupying the best positions from which they could bring to bear a most efficacious fire against well-defined and visible targets without being fired upon by artillery of equal power. As for the fortresses voluntarily evacuated it may be retained that had they attempted to resist they would have shared the same fate as the first, and it may be said with decision that the fall of Namur, Antwerp, and Maubeuge was essentially due to the attacking artillery. The author draws attention to the conduct of the French troops destined for the defence of Verdun, Toul, Belfort, who showed great activity and took all possible advantage from the favourable conditions of the ground; causing every attempt of the enemy to fail. Those fortresses which became an easy prey to the attacking Germans were completely isolated, abandoned to themselves and by their garrisons. Verdun, Toul, Belfort, on the contrary, were not only defended by their own guards, but were validly sustained by the field army.

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The author proceeds: If we desire to be just, from what modern warfare has shown up to now, it may be deduced that a permanent defensive organization is not only useful but necessary. It may also be remarked that besides Verdun, Toul and Belfort, the part represented by the strong forts of Paris have in an indirect manner enabled the supreme French command to drive the Germans from the Marne. Of the value in the strategical field of Przemysl, Cracow, Konigsberg how much is unknown? The fortresses are and always were indispensable, but they ought to be suitably organized to resist the more powerful means of offence. How may this be possible? By satisfying these two conditions: To locate the works so as to hold the enemy at a distance; and by constructing the same works so as not to render them easy targets. The first may be provided by two methods, that is by the most active offensive action of the garrison, and by arming the forts with artillery of great calibre.

Whilst, up to now, it has been held sufficient to arm the forts with guns of small and medium calibre, we ought to be persuaded of the necessity of the possibility of arming them with cannon of great calibre. With the huge guns with which the forts should be armed it would be necessary to obtain such ranges that would keep the mortars and the shells of the attack very far from the said forts and in a condition powerless against the fire of the guns of the fort.

With regard to the method of constructing the forts with a view to rendering them not easily destroyable, the author contends that it is useless to increase the thickness of the armoured covering to obtain greater protection against each cannon shot of the enemy's artillery. For this there is only one way, that is to follow the lines of field fortification by diminishing the targets, concealing the ground, and breaking up the elements as much as possible.

This is the method of permanent fortification with which the Germans now commence to fight. But there is need to record that all the fortresses of Belgium and France which were left to themselves were soon conquered; and only those which acted in strict unison with the field army have been able to present a good resistance.

The anonymous author commences his writings by saying that he is more than ever convinced that permanent fortifications are still necessary for the defence of the country. They should be able to resist for long on determined points or in regions of special importance, with small forces the forces, greatly superior to them. And it is obvious that they will serve such a scope, so much the better, as they are properly located, and their power of passive resistance will be so much the greater as is the power of their arms and equipment. As much as is the defensive organization of the fort, so much the less will be the part of the field army necessary for guarding it, and on the contrary so much the greater will be the forces of the enemy arrested in front of it.

The arguments which, since the experience of modern wars, are brought forward in support of the theories which consider permanent fortifications as impotent in the face of the new and very effective methods of attack have no serious foundation. There are indeed some

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who in their enthusiasm for the value of trenches and field fortifications, think that the latter can be substituted for permanent fortifications.

Do they not lose their senses?—exclaims the author—Do they not forget how much France owes to its fortifications? Do they not lose sight of the very great value of the German fortresses on the western frontiers in event of the troops being obliged to retire?

It should be remembered that fortresses may grow old in the same manner as ships of war. At this point the author expresses as follows the ideas according to which by his advice the permanent defence of a country should be organized.

For the purpose of properly defending its own territory against invasion a state should limit itself to constructing, near its frontiers, some fortresses and assigning to them certain special duties. As an efficacious assistance to the mobile defence by the troops, and for the absolute security of a state against an enemy's invasion, especially in a territory with open frontiers, a system of forts connected by extended lines of passive and insuperable obstacles, natural and artificial, is the only one of service. For such a system, an organization of vast entrenched camps, like those of the French at Belfort and Verdun, is not necessary; extended battle camps with permanent works are sufficient; such as will admit between their intervals of the offensive action of the troops and against which the enemy's attacks may be split up and broken.

Such a system of battle camps with permanent works should be adapted to tactical requirements in the same manner as improvised fortifications. The military engineers instructed in the duties of defending a certain zone, and holding account only of this, and of the nature of the ground, should determine the position and the structure of the necessary works, independently of any preconceived ideas. Case by case it should be decided how best such permanent battle camps can be organized, either with a line of forts or with groups of works, without rigidity, and without being strictly tied to a linear system or to that of groups. In each camp there should be strong closed works, well armed, well equipped, secure against assaults, *di viva forza*, and with great development of fire, constituting the nucleus of the whole system.

The author attaches a sketch to his article, representing one of such modern places of support, protected according to his principles, noting that the data referring to the various dimensions are only vague indications, especially as regards the thickness of the armoured protection. For general rules he offers the following:—

1st. To maintain a most efficacious fire action against the vicinity of the attack, even up to the last stage.
2nd. To support the contiguous works, fighting the intervals with batteries conveniently disposed.
3rd. To be absolutely secure against attacks *di viva forza*.
4th. To be able to impede the enemy from establishing himself in the interior.

A successful defence up to the last stage can only be effected by the following means: mitrailleuses and special guns of small calibre; the

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use of the strongest armoured protection for the guns and the garrison; the concealment from view and the disposition of such protection.

It would be difficult to construct a gallery for infantry and mitrailleuses with armoured protection without it being visible. Small protected emplacements concealed by bushes, for one or two mitrailleuses, might be preferable. Armour-covered batteries should be provided for supporting the neighbouring works by their fire, and be placed between the closed works in the positions best adapted for the purpose. Passive security should be obtained by a very extended use of barbed wire, with current at high tension, guarded by small armoured posts. To impede the enemy from establishing himself within the works there should not exist in the ditch any small places in which he could take up a position against the reserve batteries of the defence.

The author closes his article with a remark on the ungrateful duty of endeavouring to find a compromise between the principles which he recommends and the expenses spent on construction.

June, 1915.

THE STORMING OF PRZEMYSL BY THE RUSSIANS.

Extracted from the *Danzers Armee-Zeitung*, Vienna:—

The two periods of the Siege of Przemysl by the Russians extended over 165 days; about three weeks for the first and four and a-half months for the second. In the first period attempts were made to capture the fortress *di viva forza;* these attempts failed, and efforts were then made to starve out the garrison. Before October the attackers lost 70,000 men; and at least 35,000 in the second period of the siege.

This fortress which cost such a sacrifice of life to the attack was not a strong place of the first order among modern fortresses. It is over 40 years since the works of Przemysl were erected and the more important works of the fortress date from 1880. They were remodelled during successive periods of 10 years, but the armament was not modern; only two mortar batteries of great calibre were of recent pattern; the great mass of the artillery comprised a variety of types, some of the guns dating back to 1861. Most of the garrison were men of the old classes of Galician and Hungarian troops; and among the artillery were men of the Viennese Landsturm.

The defence under General Kusmanek had, in the two periods of the siege, been one of wonderful activity, compelling the Russians in the second period to remain in their own fortified position, and to exercise great caution in bringing forward their troops, and to borrow from Japan many guns of large calibre to contend against the works of the fortress.

The services rendered by the Austro-Hungarian field army at Przemysl were very great. It had a difficult duty to perform in bringing up reinforcements and ammunition as there was a decrease in the distribution of these which could not be replaced before the 5th November. Provisions were scarce, and in the second period of the siege the

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garrison was reduced to half rations, and it became clear to the commander, who always remained in communication with the supreme command by means of wireless telegraphy and aeroplanes, that subsistence would not last beyond the middle of March. Since the arrival of reinforcements from beyond the Carpathians could not be absolutely counted upon, and the sortie of the 19th March intended to break through the Russian lines having failed, General Kusmanek received orders to surrender the fortress to the enemy, after destroying all the means of defence. The surrender of Przemysl took place on the 22nd March without great advantage to the Russians.

GERMANY.

Compensation for the Recovery of Munitions and other Materials.

An order of the German War Minister contained in the *Verordnungsblatt*, N. 14, of the 2nd March last fixes the compensation that will be paid either to soldiers or civilians who recover parts of munitions and other materials from the battlefields. These compensations tend to show with what care Germany seeks to economize as far as is possible all materials that can be utilized for the fabrication of munitions, and for other military purposes.

1st. For private individuals the following compensations :—

(*a*). For objects of brass such as rifle cartridge cases and damaged artillery cartridge cases, per each kg., lire 0·60.

Aluminium, copper, zinc :—

(*b*). For artillery cartridge cases (undamaged), per each kg., lire 1·80.

(*c*). For rifle cartridges complete, per each kg., lire 0·30.

(*d*). For tins for provisions, etc., per each kg., lire 0·06.

(*e*). For fragments of projectiles with copper parts, per each kg., lire 0·035.

(*f*). For iron objects and fragments of projectiles without copper, per each kg., lire 0·01.

2nd. Soldiers receive for material recovered only one-fifth of the compensation established for civilians.

It will be the duty of all to be careful that in the search for materials by the soldiers there must be absolutely no avoidance of service.

3rd. Compensation will be paid only to those who by their own labour procure material for the military authorities, which by the same authorities would otherwise be considered as lost.

4th. For metals and for other substances that constitute booty of war (as for example the munitions of a stormed fortress) no compensation will be paid.

The German Submarines.—The *Génie Civil*, N.17, gives the information that at the beginning of 1914 Germany possessed 24 armed submarines and 14 in construction. Of these last eight have been completed. The six remaining (Nos. 33 to 38) whose construction was commenced in 1914 are not probably even now on service despite of the feverish activity displayed in 1914 in the German dockyards. The German submarines are designated by the letter U followed usually by a number

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(U-4 for example). The letter U is the initial of Unterseeboot, signifying submarine. It seems that Germany has kept for itself five submarines built for Austria, and one destined for Norway, so that at the commencement of the War 38 submarines were available. The first German submarine is stated to have been launched at Kiel in 1905. The essential details which characterize the German submarines are shown in the following list :—

Particulars.	U_1	U_2 to U_8	U_9 to U_{12}	U_{13} to U_{20}	U_{21} to U_{32}	U_{33} to U_{38}
Year of placing on the stocks	1903	1906–07	1908	1909–10	1911–12	1913
Displacement at the surface, tons	185	237	Slightly superior to type U-2.	450	650	675
Ditto, immersed	240	300		500	800	835
Length, metres	39·10	43·20		?	65	?
Width, metres	3·60	3·75		?	6·10	?
Effective power of electric motors for subaquean navigation	200 h.p.	320 h.p.		600 h.p.	800 h.p.	?
Effective power of petrol motors for subaquean navigation	400 h.p.	600 h.p.		1200 h.p.	1800 h.p.	2500 h.p.
Greatest velocity at the surface, knots	·11	12		15	16	17
Ditto, below the surface of the water	8	8·5		9	10	?
Radius of action on the surface	?	1,200 miles.		?	1,500 miles, and 12 knots	?
Ditto, below the surface ..		50 miles & 5 knots		?	70 miles and 6 knots	?
Armament	1 tube torpedo. 3 torpedoes of 450 mm.	2 tube torpedoes. 4 torpedoes of 450 m.	2 tubes. 4 torpedoes of 450 mm.	2 or 3 tubes. 4 or 6 torpedoes. 1 gun of 37 m.	4 tubes. 8 torpedoes. 2 guns of 88 m.	?

I. Five submarines built for Austria of the same characteristics as those of type U-33, U-38.

II. A submarine destined for Norway similar to type U-9. It appears, that up to the end of 1914 20 new submarines were under construction.

In 1907 Germany only possessed eight submarines, including those completed and under construction, while France possessed 85. But from time to time France lost this advantage owing to many being put out of service, on becoming obsolete and unfit for the sea. Germany, on the other hand, proceeded with great caution, as though it would seem to be disinterested in the question, leaving to others to make the more difficult trials ; and when the usefulness of small ships became certain, Germany set to work to build as many as possible, so that while in 1907 the allotment for submarines was about 6,000,000 lire, in 1910 the sum allotted had risen to 18,000,000 and in 1914 to about 24,000,000.

Austria-Hungary commenced to build in 1907, and at the commencement of the War she had six armed and four under construction at Pola, which when completed were numbered from 12 to 15. The first six were numbered 1 to 6. The numbers wanting, from 7 to 11, were due to five having been constructed in Germany and kept there.

E. T. THACKERAY.

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BOOKS RECEIVED.

RIVINGTON'S NOTES ON BUILDING CONSTRUCTION. Parts I. and II. A Book of Reference for Architects and Builders and a Text-Book for Students. Edited by W. Noble Twelvetrees. New edition, entirely re-written, with 48 illustrations. 1915. 7s. 6d. per part. Longmans, Green & Co., 39, Paternoster Row, E.C.

STRUCTURAL STEEL. R. A. Skelton & Co.'s Handbook, No. 16. 1915. Price, 10s. R. A. Skelton & Co., Moorgate Station Chambers, London, E.C.

RUSSIAN SELF-TAUGHT. With Phonetic Pronunciation. By C. A. Thimm and J. Marshall, M.A. 5th edition. 1915. Price 2s. 6d. Marlborough & Co., 51, Old Bailey, E.C.

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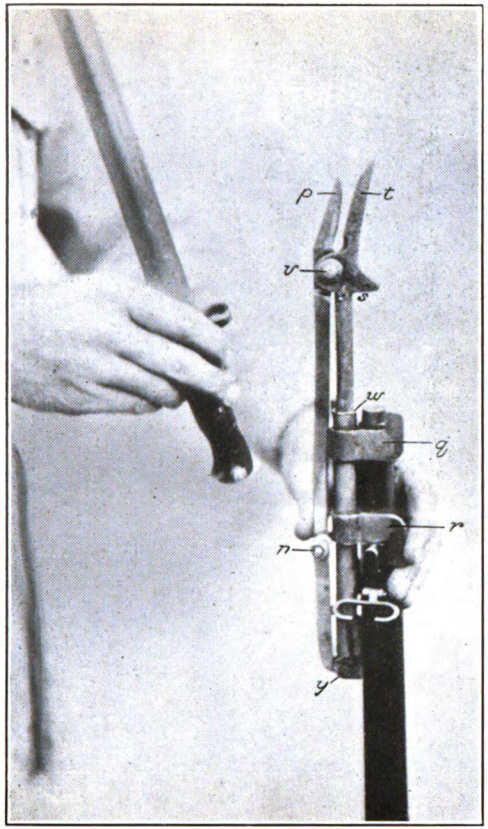
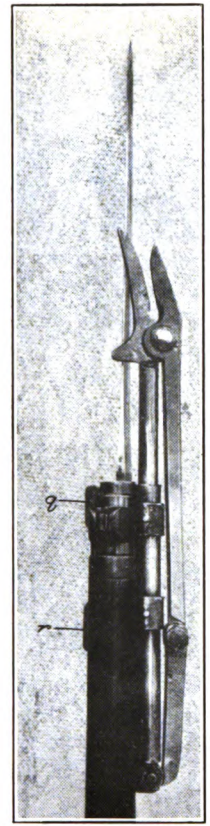
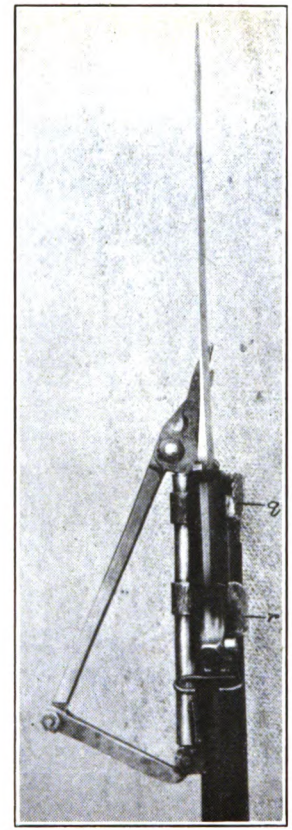
RIFLE ATTACHMENT WIRE CUTTER.







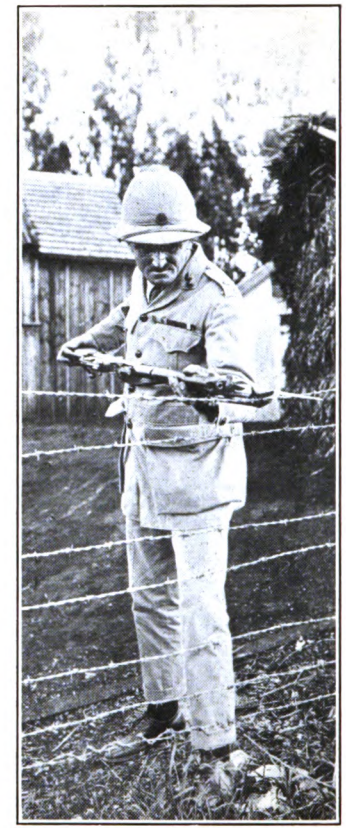


Photo I.—To show method of attaching wire cutter to rifle. (Viewed from above). Photo II.—To show wire cutter fixed to rifle and ready to receive a wire. Photo III.—To show wire cutter in position assumed at moment the wire is severed. (Viewed from below). Photo IV.—To show method of using cutter on a wire fence.

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RIFLE ATTACHMENT WIRE CUTTER.

By MAJOR R. L. MCCLINTOCK, D.S.O., R.E.

THE ideal wire cutter for military purposes should before all things possess the quality of not requiring the soldier to have more than the usual pair of hands.

No pliers wire cutter with which I am acquainted can be worked successfully with less than one hand; two are better, one to steady the wire and the other to operate the pliers. In attack, the soldier in addition requires two more hands for his rifle. These conflicting claims have to be met by slinging the rifle, or carrying it in one hand, leaving the other free for the pliers. Such compromise must obviously detract from the soldier's efficiency in either aspect of rifleman or wire destroyer.

How can this be avoided, and the soldier enabled to cut wires while still retaining his rifle in his two hands, ready for immediate use with either steel or lead? The following is an attempt at solving the problem, by No. 4 Engineer Field Park, 2nd Q.V.O. S. & M.:—

I. GENERAL DESCRIPTION.

This is a wire cutter of the pliers pattern attachable to the Service rifle and bayonet. It is designed to cut any strand of a barbed-wire fence by the simple act of lunging at it with the bayonet. It can be attached to, or detached from, the rifle in a moment by the mere act of fixing or unfixing the bayonet. When so attached, it does not interfere with the use of rifle or bayonet as such. It weighs no more than the current pattern of hand wire cutter, as issued in India.

II. DETAILED DESCRIPTION.

The wire-cutting rifle attachment comprises four main parts:—

(*a*). *The Pliers* (*pz, tk*).—These consist of two steel jaws (*pz* and *tk*) pivoted at (*v*), *vide Figs.* 3 and 4. The shank of the jaw (*tk*) is circular in section and $\frac{13}{32}$ in. in diameter—that is, capable of sliding freely in the piece of tube (*wx*), which is $\frac{7}{16}$ in. internal measurement. The shank of the other jaw (*pz*) is rectangular in section and drilled at the lower end (*z*) to receive the bolt (*n*).

(*b*). *The Guide Tube* (*wx*).—This consists of a piece of metal tube (*wx*), $\frac{7}{16}$ in. internal diameter and $7\frac{1}{2}$ in. long. Its upper end (*w*) is open and receives the circular shank of the jaw (*tk*). The lower end (*x*) is closed with the metal plug (*h, Figs.* 3 and 4), secured to the

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tube by the rivet (*g*). The lower end of this plug projects below the tube (*wx*) for $\frac{5}{8}$ in. and is drilled for the second rivet (*g'*). To this tube (*wx*) are attached the two metal lugs (*q* and *r*, *vide Figs.* 3 and 4).

(*c*). *The Lever* (*yz*).—This consists of a piece of steel (*yz*, *Fig.* 3) riveted to the plug (*h*) at one end, and connected at the other to the extremity (*z*) of the jaw (*pz*) by the bolt and nut (*n*). Both these joints are free, and the system can assume either the position shown in *Fig.* 3 or that of *Fig.* 4.

(*d*). *The Spring* (*m*).—This is a spiral steel spring (14 *S.W.G'*) of such diameter as will permit it to fit inside the guide tube (*wx*). It is 6 in. long when uncompressed and not more than $1\frac{1}{4}$ in. long when compressed as fully as possible. It is placed within the guide tube, its lower end resting on the top of the plug (*h*) and its upper end pressing against the end (*k*) of the jaw (*tk*). It will then be compressed to $4\frac{7}{16}$ in. in length, *vide Fig.* 4.

III. Method of Attaching to Rifle.

Note.—In the following instructions, the rifle referred to is that known as "Rifle, short, Mark 1*," and the bayonet is that known as the "1903 pattern."

The wire cutter is fixed to the right-hand side of the rifle muzzle as follows (*vide Photo* I.) :—

Hold the rifle between the knees, as for fixing bayonets. Place the lower edge of the lug (*r*) on the top of the upper surface of the "bayonet standard" of the rifle, the lug (*q*) resting against the underside of the "nose cap," below the "bayonet boss." Hold wire cutter and rifle muzzle together in this position with the left hand. Then, with the right, fix the bayonet on the rifle in the usual manner. The two lugs (*r* and *q*) will now be confined between the back of the bayonet hilt and the metal nosecap of the rifle (*vide Photo* II.). The cutter is accordingly immovably secured to the rifle as long as the bayonet is fixed. The top (*w*) of the guide tube comes level with the top of the "bayonet boss." The jaws of the pliers lie along and at right angles to the upper edge of the bayonet, and the portion (*ts*) of the jaw (*tk*) actually slides up and down along it as the cutter assumes the position of *Fig.* 3 or *Fig.* 4. The cutter is again detached from the rifle merely by unfixing the bayonet.

IV. Method of Use.

Lay the flat of the bayonet on the top of the wire to be cut (*vide Photo* IV.). The jaws of the cutter will then be at right angles to the line of the wire, and open as in *Fig.* 1. Then lunge with the bayonet sliding across the wire. The latter will slide straight into the jaws, which will at once close over and cut it (*Photo* III.). They will then immediately open again for the next wire.

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V. Explanation of Action.

On the lunge being delivered, the wire slides along the flat of the bayonet into the jaws of the cutter (*tvp*). It can go no further, and so presses against the bottom of the jaws (*v*). This gives before the pressure, the shank (*tk*, *Fig.* 4) sliding down the guide tube (*wx*), till brought up in the position shown in *Fig.* 3 by the shoulder (*s*) bringing up against the top of the tube (*w*), and the "bayonet boss" of the rifle. As this shank (*k*) retires down the guide tube, it compresses the spring (*m*) before it, till at the end of the movement the spring is fully compressed (*Fig.* 3). This movement of the jaw (*tk*) from its *Fig.* 4 position to its *Fig.* 3 position, at the same time causes the jaw (*pz*) to close over the wire and cut it. The instant the wire is thus cut, its pressure on the bottom of the jaws ceases, and the spring (*m*) again expands, returning the jaws to their original position (*Fig.* 4) and opening them again for the next wire. Wires can thus be cut as fast as lunges can be delivered.

VI. Advantages Claimed over Hand Wire Cutter.

(*a*). That the soldier attacking an entanglement can demolish it while still retaining his rifle in his hands, ready for instant use with bullet or bayonet, instead of having to sling it or lay it down, as is the case if he is using the hand wire cutter.

(*b*). That owing to the leverage obtained and to the utilization of the weight of man and rifle in closing the jaws of the cutter, thicker wire can be cut than with the hand pattern in which the leverage is less, as the applicable force is limited to the strength of the man's grasp.

(*c*). That a wire entanglement can be more rapidly destroyed than with the hand pattern, and the wire adjusts itself automatically in the jaws instead of having to be felt for.

VII. Remarks.

(1). The wire cutter described was constructed to fit the "Rifle, short, Mark 1* and the Bayonet, 1903 pattern," *i.e.* the *short* bayonet, as the inventor's unit was thus armed. To make it fit the short rifle with the subsequently introduced *long* bayonet, the opening of the upper lug (*q*) must be made somewhat wider, as the ring of the latter bayonet is a little broader. It has not so far been fitted with the old "long" rifle and bayonet, as but few are in use; it would, however, only be a question of rearranging the lugs (*q*) and (*r*).

(2). The photos do not absolutely tally with the drawings, as they were taken of a slightly older pattern. There are a few minor differences, notably in the attachment of the lower end of the lever (*yz*) to the bottom of the tube (*wx*).

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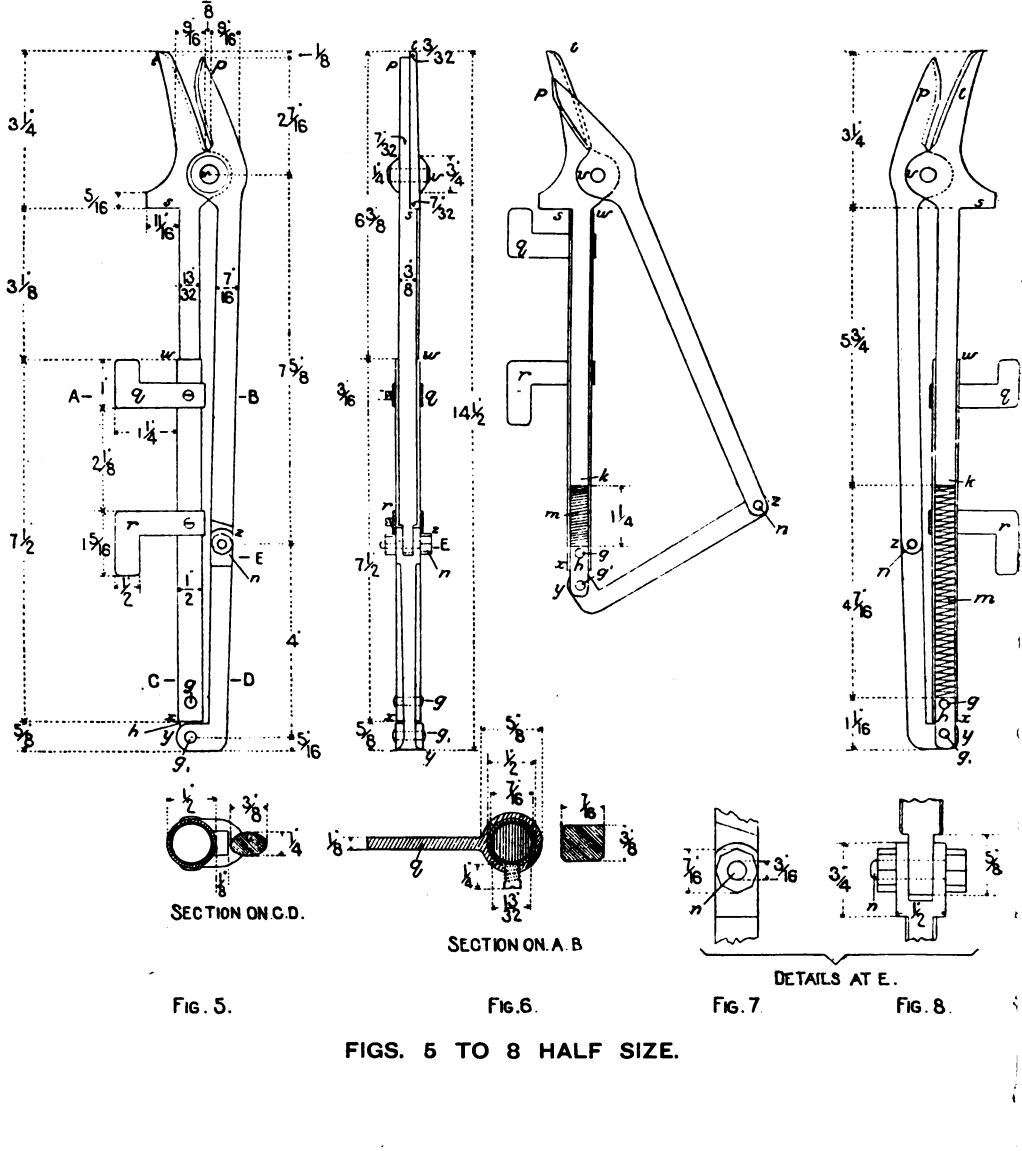
(3). This cutter is only adapted for cutting taut wire, or wire which will become taut under a continued thrust. It will not cut wire lying loose on the ground, as this offers no resistance to the lunge.

My thanks are due to Staff-Sergt. Rogers, of No. 4 E.F.P., who was of the greatest assistance to me in evolving the above wire cutter.

FIGS. 1 TO 4 QUARTER SIZE.



FIGS. 5 TO 8 HALF SIZE.

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HINTS ON PANORAMA SKETCHING.

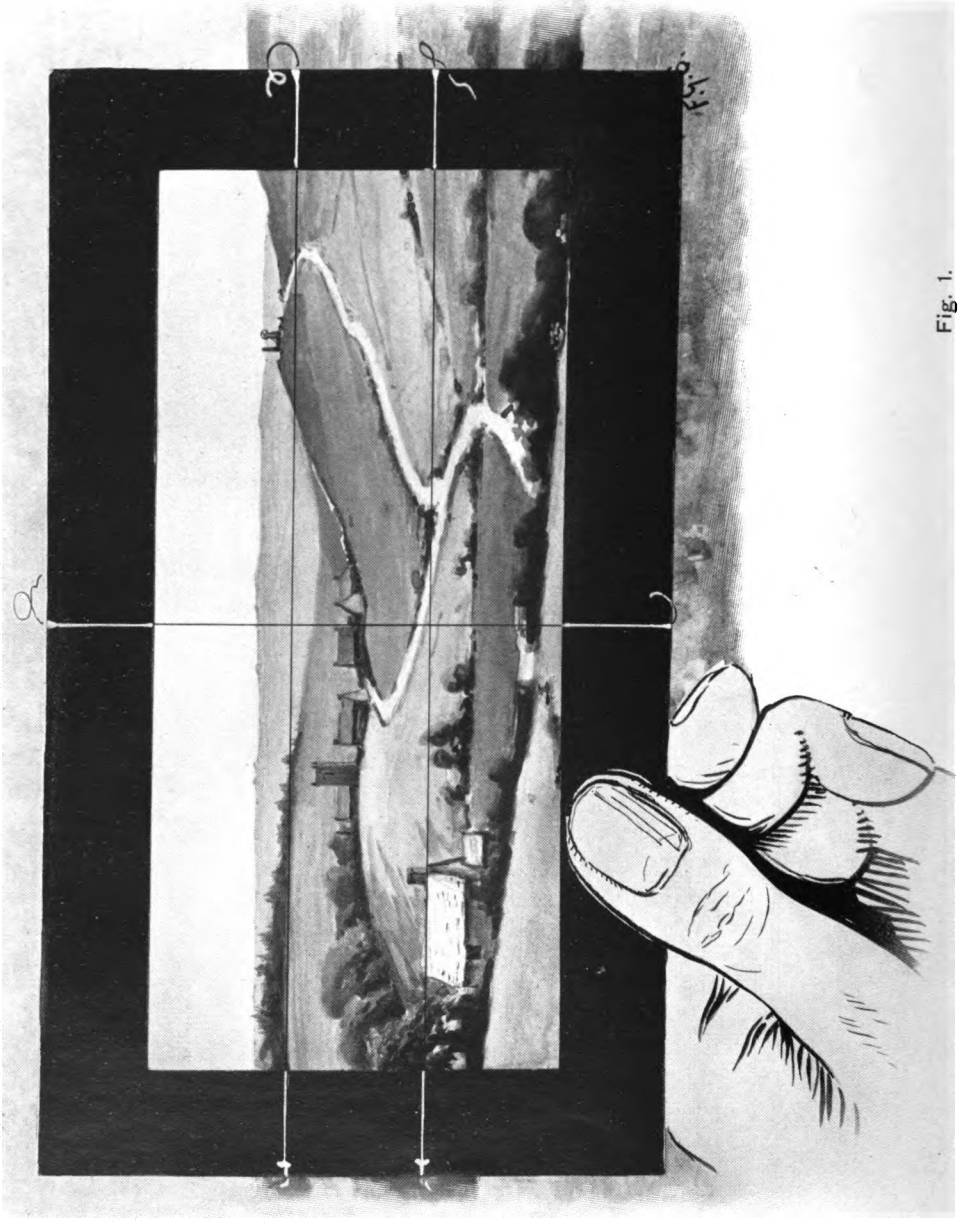

Fig. 1.

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HINTS ON PANORAMA SKETCHING.

By E J. McKaig, A.M.I.C.E., R.E. (T.).

The following remarks are not intended to apply to the accomplished artist, or to those skilled in drawing landscape from nature; but it is hoped they will be of some assistance to others who either from lack of opportunity, inclination, or both, have never seriously attempted to understand perspective, or to put on paper accurate impressions of their observations, in such a way, and as few lines as possible, to be a true record of value to another person. Further it must be understood there is no attempt to strive after artistic effect, or picture composition; such things being outside the province of a sketch made under and for military conditions and purposes, during reconnaissance, as an adjunct to sketch maps or written reports.

All that is required is that it shall be as true a drawing as possible, giving an accurate idea of the appearance and character of the surrounding country.

As in the case of all military training, and rules laid down in manuals, these hints are not to be taken as an end in themselves, but as a means to an end; although the methods described could be used in actual practice, to some advantage, they are primarily intended to assist in training the unpractised to see and draw things as they really appear.

The subject dealt with here is, what would be called "sketching on blank paper" but in the first attempts it is suggested that the paper shall not be blank, but ruled as shown in the illustrations. This is to enable the beginner to put down the relative proportions or depth, of distance, middle distance, and foreground; the whole success of the sketch entirely depends upon this point; and the first stage of the sketch can well be put down in three lines, each line representing one of the three distances. This three-line method will be found a good one to follow always, and any detail required, or extra lines, put in afterwards in their true relative positions to the distance, middle distance, etc. In some lights to the beginner, it may be rather difficult to divide the panorama or landscape up into these three layers, but with a little practice, it will be found quite easy and more readily observed in morning light, after sunrise, and similarly before sunset; or during the first signs of twilight. With a little practice it will soon be found a simple matter to divide

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most scenes into three layers or lines, and when properly mastered more lines can be used to advantage, but generally, the three will be found adequate.

The trouble with the beginner is that he sees too much, and the vastness of the scene before him confounds him and results in confusion.

A useful exercise is to practise observing; that is, when looking at any landscape, to mentally divide it up as described, and decide exactly the extent and outline of the middle distance, because after all it is this central portion of the sketch that is important and really makes for good or bad perspective. The materials required are some pieces of paper of a suitable size, pencils, and a piece of cardboard, prepared as shown in *Fig.* 1 and later described, called the picture finder.

The size of paper used may of course be anything, but it is wise for the beginner to make his first attempts on sheets of the same size or at least of the same proportions, such as 8 in. × 4 in. or 12 in. × 6 in., 9 in. × 3 in., or 12 in. × 4 in. and so on, or use a sketch book of the type called the press sketch book, having perforated leaves, and sold by most artist material retailers.

The sheet to be drawn upon should then be prepared by ruling faint lines across it as shown in the illustration; these may be made in pale blue, or diluted ink, and failing this, in thin pencil lines; blue lines however will be found best, because they will not become confused with the lines of the sketch. These lines can be of any number, but two equidistant horizontal, and one vertical, will be found sufficient for ordinary purposes; the arrangement being in the same proportion as the lines or webs of the picture finder, which need be nothing more than a piece of cardboard of suitable size to be carried in the sketch book or pocket, preferably black, and having an aperture cut in it of similar proportions to the sheet to be sketched upon, and fine threads stretched across the aperture in the same ratio as the ruling of the paper (see *Fig.* 1).

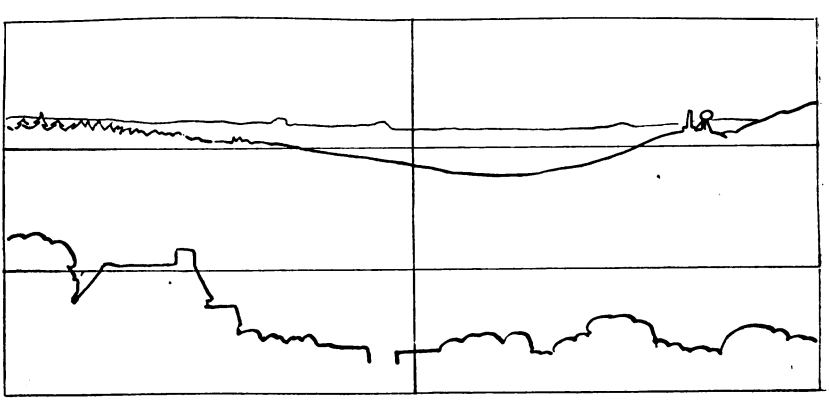

FIG. 2.—*First Stage.*

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Another type of finder can be a piece of framed glass, with lines ruled upon it, but the cardboard one described, will be found just as effective and easier to make and carry.

The picture finder is then held up, and the panorama to be drawn observed through the aperture, the distance from the eyes being adjusted until all that is required is visible; and whilst in this position it is carefully noted where the main lines cut the edges of the aperture and cross the threads or webs. Points coinciding with these are then marked on the sheet, using the ruled lines to represent the webs of the picture finder. When these points are fixed, proceed to draw in the line of the horizon through them, care being taken to give the character of the observed outline to the line (*Fig.* 3).

FIG. 3.

Then proceed with the middle distance, which will naturally be shown in more detail, and follow with the foreground.

The three main lines of the panorama are now completed and any further detail can easily be put in where it occurs in relation to these main lines, and in such amount as the requirements of the drawing necessitate, together with written notes and descriptions as in the specimen completed sketch, *Fig.* 4.

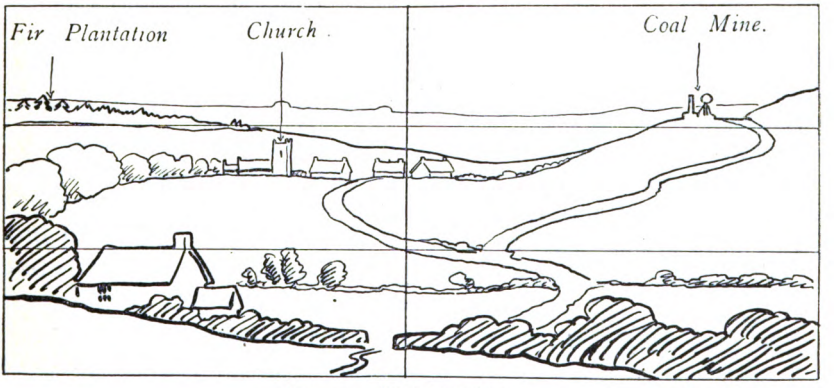

FIG. 4.—*Finished Sketch.*

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Another important point to obtain good results is the varying strength of line; the distant horizon being represented by the finest line, the strength increasing towards the foreground. A simple way to obtain this is for the beginner to use three pencils—H, HB, and B, each degree of hardness being used for the three lines respectively, or if one pencil only is used, say B, and the sketch commenced at the horizon, with a fine point, the pencil will wear down as the work progresses and automatically give the required varying strength. This however is a matter of technique and will come with practice. In a little time all the varying shades and feeling of line will be found to come naturally, the picture finder and ruled paper becoming superfluous, but until such time it is hoped the methods given will be found to be of assistance to the unskilled draughtsman, to whom, as already explained, these remarks are addressed.

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SIEGES AND THE DEFENCE OF FORTIFIED PLACES BY THE BRITISH AND INDIAN ARMIES IN THE XIXth CENTURY.

(*Continued*).

By COLONEL SIR EDWARD T. THACKERAY, V.C., K.C.B. (LATE R.E.).

CAPTURE OF MAGDALA, 1868.

His Royal Highness the Duke of Cambridge in describing in the House of Lords the operations in Abyssinia under General Sir Robert Napier (afterwards Field Marshal Lord Napier of Magdala, G.C.B., G.C.S.I.) declared that "his every step had been a success and a triumph." As Commander-in-Chief of the expedition, before he took the field Sir Robert Napier, as a philosopher in his study, planned a piece of mechanism, of which every piece of military arm, every military department, and every branch of military science were the polished *wheels*, the whole to be kept in motion by one highly tempered *main spring*.

In the Abyssinian War, Sir Robert Napier's "thin red line" was an arterial line of communication a few feet only in breadth, but in length extending from the Red Sea to the Amba or Citadel of Magdala; upon the vitality of this arterial line, the life of the invading army depended. If, throughout its enormous length, pulsation at any one point had ceased, mortification at the extremity must inevitably have ensued. From Zoulla, in spite of physical obstruction of every description, it stretched itself onwards for nearly 400 miles, through the scarped and counterscarped gigantic outworks of the Citadel of Magdala, until within its second gate, it reached the self-condemned, self-executed, ghastly corpse of King Theodore. And then as the victorious army returned it instinctively contracted, until on the embarkation of the last regiment at Zoulla, as if its commander signalled to it to depart, it vanished. On the march through a region of the world in which war had always been disgraced by robbery, murder, and mutilation, he induced the troops "to be true and just in all their dealings." To keep their hands from picking and stealing, and in the battlefield, to do unto their wounded enemy "as they would he should do unto them."

Bearing no malice or hatred in his heart, he offered not only to forgive, but also to give honourable treatment to King Theodore, who for many years had trespassed against Her Majesty the Queen

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and her subjects. King Theodore shortly before he gave the fatal pull to the trigger of his revolver, wrote to his conqueror, as his last dying speech and confession: "Since the day of my birth, whenever my soldiers began to waver in battle, it was mine to arise and rally them. Yesterday, though I killed and punished my soldiers they would not return to the battle. You have prevailed against me by people brought into a state of discipline."

At sunrise on the morning of Easter Monday, April 13th, 1868, Theodore arose and calling to his troops said: "Warriors who love me, gird yourselves; leave all behind, take nothing but arms and follow me; the time has come to seek another home." He had apparently determined to make an attempt to escape, and went out of the fortress near the Kiffir-bir Gate at a place where it was possible to descend towards Sangallat. He was followed by two chiefs of rank, and about 2,000 men, variously armed. As he passed down he asked where the advance guard was, and on being told that they were in rear, ordered them to the front. They refused, saying that they would never flee before an enemy again, and would rather seek death in Magdala. Theodore pondered for a brief space, and then saying "Let it be so" re-ascended the mountain. It would have been impossible for him to continue his journey alone, as the cries of the Gallas, who, under the guidance of Meer Akber Ali, were watching the issue from the fortress on that side, could be distinctly heard. On re-entering the fortress, he told all who were not prepared to share his fortunes to the last to provide for their own safety. Thousands thereupon left him, and ultimately surrendered to the British.

It was a fine sight, the long line of red, Royal Engineers, toiling under their scaling ladders, Sappers, 35th and 45th Regiments, the 4th King's Own, the Beloochees in their dark green, the Royal Artillery in blue, and the mountain batteries on mules, toiling up the steep ascent that led to the Fahla saddle; while down by the side of the hill by every sheep track, streamed the soldiery of Theodore, who had surrendered to Capt. Speedy, and laid down their arms. Old men and boys, mothers, and families, with their household treasures, were seeking an asylum in the Arogi Valley till the storm of war should be over above. Sword and helmet sparkled in the morning sun, the banners were unfurled, the breeze was just enough to display their gay colours, and all nature seemed to contribute to the splendour of the pageant.

Inspirited as the soldiers were by the thought that their toils were now almost over, and that success was about to crown their enterprise, their ardour was also strengthened by the uncertainty which surrounded everything up to the very last moment. For all anybody knew to the contrary, Theodore might have 10,000 armed men in battle-array on the top.

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About 4 p.m. the order to storm was given. The mountain batteries kept up as long as possible a fire over the heads of the troops advancing to the assault. The 33rd Regiment led by Major Cooper, and keeping up a continuous fire from its skirmishers, soon surmounted the steep precipitous cliff which lay between it and the outer gate, notwithstanding the fire of the garrison from behind its defensive line, which consisted of a wall surrounded by thick and strong barricades of thorny stakes, with a narrow stone gateway. The gate being closed, the progress of the assailants was arrested, and for the moment the powder bags with which to blow it in were not at hand. On arriving close to the gate the enemy opened fire through loopholes, by which Major Pritchard, R.E. (afterwards Lieut.-General Sir Gordon Douglas Pritchard, K.C.B., Colonel Commandant, R.E.), two non-commissioned and one sapper were wounded, and Lieut. Morgan at the same time received a severe contusion on the head and shoulders from stones.

Major Pritchard thus describes the affair: "About 2 p.m. when it was decided that Magdala should be taken by assault, I received orders to send back for the ladders, powder barrels, bags, etc. (these by order of Sir C. Staveley had been left at the foot of the cliff). I accordingly sent a detachment who brought up the ladders, the two barrels of powder, the fuze, etc., but not the powder bags, which on inquiry I found had been taken by the natives for their original purpose of carrying water. I reported the circumstance to Sir C. Staveley and informed him that I could if necessary, blow open the gate of Magdala with one of my barrels of powder and fuze. About 4 p.m. the Engineers took the post of honour, carrying our entrenching tools, ladders, two barrels of powder, fuze, etc., and led the way along a path on the side of a precipice to the gate, on the right of which over the wall we effected an entrance by climbing and using our ladders."

The entrance was made at two points, Corpl. M'Donough, R.E., being the first man in at one, whilst Major Pritchard, Lieut. Le Mesurier and Sapper Bayley (one of the flag signallers) entered at the same moment by escalade at another. Immediately following them the 33rd Regiment forced its way over the stockade at the right, and joined Pritchard and his small party within the gateway. They then made a dash at the upper gateway which was not defended, the enemy flying in all directions. Here they found the body of King Theodore, who had shot himself on realizing that his troops could make no stand against the British forces. The summit of the fortress was quickly occupied, the British standard was planted upon the African rock which had been so long the prison-house of British envoys, and Magdala was captured. The followers of Theodore immediately threw down their arms and prayed for quarter, which was of course granted, and no further loss of life occurred.

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So ended the war and the prisoners were rescued. On April 17th Magdala was burnt to the ground, and the fortifications destroyed. The army wended its way back as rapidly as possible and re-embarked on reaching the base. This fortress, which was comparatively easily carried, might (owing to its outworks, Fahla and Selassie which added so much to its strength) have been made impregnable.

If Theodore had been properly supported by his soldiers, the British could not have escaped severe loss in its attack. As it was however his army had been so completely demoralized by the severity of the loss inflicted two days before, that the troops remaining faithful to Theodore were few; and when they found that their unscientific defences gave them no opportunity to inflict loss on the assailants, without exposing themselves to the fatal fire of the breechloaders, they abandoned the contest as soon as their first line of defence was carried by the stormers.

This campaign has a peculiar interest for the Royal Engineers, in that it is the first in which the supreme command was entrusted to one of their Corps. The difficulties attending the operations were probably more considerable than would be encountered in most campaigns, but it was universally admitted that, great as those difficulties were, they were clearly foreseen and admirably provided for.

Officers of Artillery and Engineers have since been employed in high positions in command of troops other than those of their own services, and the results have proved as satisfactory as in the case of the Abyssinian Campaign. The peerage earned by Lord Napier of Magdala shows the value set by public opinion on his work, but he has received beyond this the warm gratitude of his brother officers, for having demonstrated how fallacious was the idea that men of the scientific corps were wanting in the military genius necessary for the command of an army.

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REVIEWS.

GERMANY'S VIOLATIONS OF THE LAWS OF WAR, 1914–15.

FROM A REPORT COMPILED UNDER THE AUSPICES OF THE FRENCH MINISTRY OF FOREIGN AFFAIRS.—*By* J. O. P. BLAND.—(Published by William Heinemann, London).

THE Great European War now raging within gun-sound distance of the British Isles has been productive of many surprises; none of these, however, seems to have been more unexpected, if the situation may be judged by the correspondence which has been published in the Press of the neutral and belligerent nations, than the black savagery practised by German troops on the innocent civil populations of Belgium and France from the time that they crossed the frontiers of the former country. Many there are, in all parts of the world, who are anxiously enquiring whether the acts of enormity with which the Teuton hosts are charged have been purposeless or purposeful. Some of the acts of barbarity (to which the term "frightfulness" has, *faute de mieux*, been applied) alleged against the German soldiery were so unlooked for and hideous in their nature that many would not, and could not, give credence to the reports on the subject which gained currency last year. Commissions and committees have, as is well known, been appointed to investigate and report on the subject. The report of Lord Bryce's committee dealing with the atrocities committed by German soldiers in Belgium and in France has been in the hands of the public for some weeks past and has thrown a lurid light on the conduct of the German Army.

More recently the French Government has published the Report of a Commission appointed, on the 23rd September, 1914, for the purpose of inquiring on the spot into the breaches of International law committed by the enemy. This Report contains, in addition to the letterpress, many photographic reproductions of German documents bearing on the inhuman and barbarous conduct charged against the German Army and its leaders. A translation has been made of the French Report by Mr. J. O. P. Bland and has just been published, together with an introduction by the translator, by Messrs. Wm. Heinemann of London; the evidence, which is here reproduced, will enable the masses of the English-speaking races to form a more or less correct opinion on the subject of the atrocious conduct charged against the enemy. Whether the acts committed were purposeless or purposeful is difficult to judge from the evidence so far brought to light, but what evidence there is points conclusively to the fact that the Teuton soldiery have proceeded about their abominable work against the unoffending and innocent civil

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population with great deliberation and under the orders of superior authority. Under all the circumstances, therefore, it is thought, the presumption may safely be made that the acts alleged against the German Army have not, at all events, been altogether purposeless.

In his introduction to the volume under review, the translator points out that in compiling and publishing the Report of the French Commission "the French Government aims at bringing into full relief the fact . . . that as a matter of deliberate and predetermined policy the German Government and the German Army have persistently sanctioned the systematic violation of the Geneva and Hague Conventions." As regards the evidence which has been accumulated by the French Commission the translator remarks: "It includes little which impartial opinion can ascribe to the passion or prejudice of hostile witnesses. Most of these documents . . . are of German origin; they deal only with the War on land and with Germany's flagrant violations, by order of responsible authority, of her definite pledges recorded in Treaties and in the Conventions of the Hague." No attempt has been made in the Report to appeal to the emotions but, clearly perceiving the psychological factor, the French Government acting with deliberation "has confined itself to a clear line of direct indictment and carefully avoided all debatable side-issues. . . . Its object is to convict the German Government of calculated bad faith, and the German Army of criminal outrages, by the evidence of their own recorded words and deeds."

The enormity of the offences committed by the German Army is unfortunately gigantic, but it is difficult to account for the very considerable surprise which appears to prevail concerning Germany's methods of making war. There must be many British subjects alive to-day who have heard from the lips of relatives, domiciled in France in 1870–71, of the outrageous conduct of German soldiers during the Franco-German War of that date, and of the fact that even the status of their relatives as neutrals protected neither their persons nor their property from molestation, and how Prussian soldiers, maybe after pillaging the contents of their homes, set fire to the buildings which housed them. The translator of the French Report opportunely quotes an extract from a letter from the pen of Sir Edward Hamley published in the *Times* in January, 1871, in which the distinguished general, *inter alia*, states:—"The 'laws of war,' as promulgated by the Prussians, may be condensed in the case of invasion into the general axiom that the population of the invaded country lose their rights of property and of personal security, while the persons and effects of the invaders become absolutely sacred."

A perusal of the documents in the Report of the Commission show that, in spite of all the agreements made between the nations of the world and to which Germany herself was a party, the barbarous methods practised by Germany 45 years ago have been pursued, with aggravated violence, by the German Army as part of the "hacking-through" policy in the present War. In the Preface to the French Report reference is made to the definite obligation the German Empire entered into at The Hague in July, 1899, to give effect to and to act in accordance with the

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rules and regulations embodied in the "Convention concerning the Laws and Customs of War on Land" made and agreed to by the representatives of all the civilized nations of the world; rules and regulations which had for their object, (i.) the mitigation of the rigours of war, so far as non-combatants might be concerned, and (ii.) the treatment of combatants in accordance with the newer conceptions of humanity dictated by the progress of modern civilization. No secret is made of the fact that the signatory powers were profoundly disturbed, in 1902, on the appearance in print of a manual entitled "Kriegsbranch im Landkriege" ("The Laws of War on Land") published by the Great General Staff at Berlin. In this manual, the German officer was put "on his guard against the *humanitarian ideas* which inspired the Conferences of Geneva, of Brussels, and The Hague, and it lays down for him rules of conduct which very frequently, even in essential matters, are opposed to the stipulations of the Conventions of 1899"; stipulations to which Germany herself was a party. The contents of the Report of the French Commission are arranged under the following 10 headings:—

I. Violation of the Neutrality of Luxemburg and Belgium.
II. Violation of the French Frontier before Declaration of War.
III. Killing of Prisoners and Wounded.
IV. Looting, Arson, Rape, and Murder.
V. Violations of the Geneva Convention.
VI. Use of Forbidden Bullets.
VII. Use of Burning Liquids and Asphyxiating Gas.
VIII. Bombardment of Fortresses without Notice, and of Unfortified Towns; Destruction of Buildings consecrated to Religion, Art, Science, and Charity.
IX. Treacherous Methods of Warfare.
X. Cruelties Inflicted on the Civil Population.

In the first chapter extracts are reproduced from Article 2 of the Treaty of London, May 11th, 1867, and from Articles 7 and 25 of the Treaty of London, November 15th, 1831, in which the neutrality of the Grand Duchy of Luxemburg and of Belgium are guaranteed. These extracts are followed by others from the French Yellow Book, the Belgian Grey Book, and the British White Paper relating to the violation of the neutrality of the Grand Duchy and of Belgium and to the rupture of diplomatic relations between Great Britain and Germany.

The second chapter begins with Article 1 of Convention III. of The Hague which requires a "clear preliminary notice" in the form of a declaration of war to be given by the contracting powers before the commencement of hostilities. The orders and instructions issued to French troops, to prevent any violation of the frontier of Germany or that of neutral countries, are reproduced *in extenso*. These are followed by the reports made by officers of the Custom Service and others stationed at various points between Rougement and Delle (in the region east of Belfort) dealing with incidents connected with the violation of the French frontier on the 2nd August, 1914, yet Germany did not declare war on France until 6.45 p.m. next day. A sketch map is inserted on which are marked the 11 points on the frontier at which it is definitely

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known German troops crossed prior to the declaration of war. In many of these cases fire was opened by the enemy on French Police and Customs officers who were naturally ignorant that a state of war existed.

An extract from Article 23 of the Regulations of The Hague which declares that, " It is forbidden :

(*c*). To kill or wound any enemy who, having put down his arms or no longer having means of defence, has surrendered at discretion.

(*d*). To declare that no quarter will be given "

heads the third chapter. This extract is followed by numerous police and other official reports relating to the massacre of wounded French soldiers and of prisoners of war, not only singly, but occasionally in batches of even 30 to 60 soldiers at a time. The statements made by witnesses testify to the revolting circumstances under which these crimes were committed and cruelties practised and to the callous indifference shown by the German officers and men to the feelings of the combatants and non-combatants called upon to witness the murders of the most brutal description committed by them without the slightest provocation. A young woman, 22 years of age, tells of a case which occurred on the 29th August, 1914; she states : " Thirty soldiers of the 99th Regiment of Infantry came to take shelter in this cellar (*i.e.* in her father-in-law's house). They were discovered by German soldiers. Seeing the Germans, the French soldiers laid down their arms and gave themselves up as prisoners. My father-in-law, who speaks German, conveyed to the Germans what the French soldiers were saying, but one of them replied in German, 'We do not want prisoners.' They made the French soldiers come out of the cellar and then compelled them to go down on their knees in the garden which adjoins the house ; later they led them to the front of the house, and placed them up against it, a yard's distance from the wall, facing towards the road, and there they shot them. I did not witness the last part of this scene, for I was utterly overcome ; I only heard from the cellar the noise of the firing, and the last anguished cries of the French soldiers. A few moments afterwards I came out and there I saw, stretched side by side and lifeless, the 30 Frenchmen."

In another case a private of the 254th Regiment of Infantry made a statement when *in extremis*, relating to the massacre, on the 22nd or 23rd September, of some 50 or 60 men of his regiment made prisoners near Mouilly (Meuse), in the following terms :—" After having disarmed them, a German captain drew his revolver and blew out the brains of the adjutant. This was the signal for a general massacre. The soldiers, under this captain's orders, proceeded to shoot the Frenchmen point-blank. Not a single one was spared."

Evidence from German sources is also published in this chapter ; it indicates that the killing of prisoners was carried out in compliance with a predetermined policy. The French Government learnt in September, 1914, that General Stenger, commanding the 58th Brigade, had given orders to his troops to kill their prisoners. One of the forms in which this order reached the French authorities is as follows :—

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"From and after to-day no more prisoners are to be taken. All prisoners are to be massacred. The wounded, whether with or without arms, are to be killed off. Even when prisoners are in regularly constituted units they are to be killed. No living enemy must be left behind us."

The following extract from the note-book of a N.C.O. of the 85th Regiment of Infantry, 9th German Army Corps, has a particular interest in this country (the photograph of the original is published in the work under review):—"October 6, 1914. We wanted to take the fort at once, but we had first to camp at Kessel (to the E. of Antwerp). The captain called us round him and said: 'In the fort we are going to take there will very probably be English soldiers. But I don't wish to see any English prisoners with my company.' A general Bravo of approval was the answer."

The fourth chapter deals with the laws, rights, and duties affecting Militia and Volunteer Corps (Arts. 1 and 2 of the Regulations of The Hague), and those affecting family honour and looting (Arts. 46 and 47 of the Regulations of The Hague).

In order to have a pretext to justify the atrocities committed by the German troops, a communiqué was published in the *North German Gazette* of the 15th August, 1915, charging France and Belgium with acts contrary to the law of nations in regard to the organizing of the civil population for warlike purposes. The French Government, four days later, addressed a memorandum to the Powers in which a most vigorous protest was entered against this defamatory accusation.

Much evidence is reproduced in this chapter relating to the wanton destruction of private property without any justification whatever, the ill-treatment of aged and infirm persons of both sexes, the violation of young and elderly women, the wounding and shooting of young and old, of men and of women. The evidence of a German private of the 57th Regt. of Infantry in relation to one of these incidents reads as follows:—

"We brought the women out (*i.e.* out of a house at Metten) and took them to the major, and then we were ordered to shoot the women.

"The major was called Kastendick and belonged to the 57th Regiment of Infantry. When the mother was dead the major gave the order to shoot the child, so that the child should not be left alone in the world, and when the mother was shot the child was still holding her hand, and as she fell she pulled the child over with her."

The heartrending scenes appear, at times, to have been too much even for the Teuton; a soldier of the 32nd Regiment of Infantry records in his note-book: "Women, children, and old men stand at the end of the village weeping and holding up their hands, a dreadful moment for me. My eyes fill with tears."

Another private (of the 1st Regt. of Light Horse), writes: "In a general way it was necessary to order many punishments that were disastrous for the population, sometimes indeed unjustly, and it is unhappily true that the evil elements felt authorized to commit nearly every kind of misdeed." Further in the letter, he refers to the looting of houses and "befouling" of everything by his comrades and admits "that every right-thinking person must be filled with horror at the misery of the War."

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The following extracts from the diary of a German N.C.O. of the 38th Regiment of Fusiliers (Silesians) is of interest :—" Beer was brought along in cases in exchange for a receipt which is certainly worthless. Alas! how quickly one sees the *bête humaine* revealing itself in many a soldier; it was not long before we could tell whether our 'kultur" was a mere surface varnish or something more deeply rooted." And "All rights of property are abolished; we are doing infinite injury to our reputation."

The foregoing extracts show sufficiently clearly how very completely the discipline of the German Army broke down on its transformation from a peace to a war status; these extracts represent but a small part of the evidence which has been collected in relation to the particular class of wrongdoings of the German Army dealt with in this chapter, and even then perhaps not in relation to the most diabolical of the crimes committed. One of the worst cases on record is testified to by a lieutenant of the 8th Bavarian Regiment of Infantry (Reserve) who witnessed the shooting of the father of a family by a Bavarian soldier with " incredible brutality " in the presence of his wife and child.

The fifth chapter treats of the utter disregard shown by German officers and men to the provisions of the Geneva Convention; not only has cruel treatment been inflicted on wounded men under the protection of the Red Cross flag, but the evidence collected also places on record facts connected with the deliberate shooting of medical officers and stretcher-bearers whilst in the performance of their duties.

In the sixth chapter are given photographic reproductions of cartridges with explosive bullets, which had apparently been dropped by German soldiers on the field of battle in the early days of the War, together with reports on these cartridges prepared by the Director of the Technical Branch of the Artillery at Paris. A report on the nature of wounds produced by the use of " reversed " bullets is also to be found in this chapter.

The seventh chapter opens with extracts from the Declaration of The Hague, July 29th, 1899, and Regulations of The Hague (Art. 23), which forbid the use of projectiles the sole object of which is to disseminate asphyxiating or deleterious gases, and prohibit the employment of poison or poisoned weapons, and of arms, projectiles, or material calculated to cause unnecessary suffering.

A memorandum drawn up by the French Government on 29th April, 1915, included in the Report states :—

" For some time past, the French military authorities have noted the abominable methods used by the German troops against the armies of the Republic, in violation of all the undertakings solemnly given by the German Imperial Government to the other Powers, and in contempt of all the sentiments of humanity."

In connection with this memorandum a photograph of a type-written document relating to flame projectors is reproduced; therein it is stated that, " The waves of flame have an effective range of 20 square metres. Their deadly effect is instantaneous, and they throw back the enemy to a considerable distance by means of the great heat they generate."

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The memorandum continues: "No government can remain defenceless against such refinements of barbarity without endangering the safety of its troops. The Government of the Republic, governed solely by its military exigencies, accordingly proposes to adopt every means calculated to prevent the German soldiers and military authorities from committing their premeditated crimes and murders."

In a report from the Minister of War to the Minister of Foreign Affairs dated May 6th, 1915, it is stated that the asphyxiating medium used by the Germans against the French lines was chlorine, although apparently in some quarters the opinion was held that it was a mixture of bromine and gaseous hydrochloric acid which had been used.

In this chapter are also included a clinical, anatomo-pathological and histo-chemical study of cases of poisoning by the irritating gases used by the Germans, the details of which are somewhat too technical for reproduction in this article.

The eighth chapter is concerned with the violations of the provisions of Arts. 25, 26, 27 and 46 of the Regulations of The Hague, extracts from which are quoted. By the terms of these articles the attack or bombardment of undefended towns, villages, dwellings, or buildings is forbidden, and provision is made for sparing, as far as possible, buildings dedicated to public worship, art, science, or charitable purposes, historic monuments, and hospitals. It is further provided that family honour and rights, individual life and private property must be respected.

The little respect which has been shown to these provisions of The Hague convention is thus briefly summed up in the Report: "The German Army, in France as in Belgium, bombarded and destroyed so many towns and villages, so many buildings dedicated to art, science, and charitable purposes, without any military purpose, and these crimes have been so openly committed in the sight of the world that it will be unnecessary to cite many documents here." Copies of the document addressed by the French Government to the Powers, protesting against the first bombardment of the town of Pont-à-Mousson, and of two documents relating to the bombardment of Rheims Cathedral are reproduced in the Report of the French Commission.

The ninth chapter deals very briefly with the treacherous methods of warfare practised by the Germans. The evidence on this subject shows that prisoners of war have been placed in front of German troops so as to be exposed to the fire of the Allies, that French women have been made to walk in front of German troops so as to act as a screen, and that French women and children have been placed at the windows of houses, during an attack on a village, whilst German soldiers stood behind them for the purpose of firing on French troops engaged in the attack on the village.

A letter from a Bavarian officer published in the *Vorabendblatt* of the *Münchener neueste Nachrichten* of the 7th October, 1914, reproduced in the Report, openly avows the lengths to which German officers have gone. In it the writer tells of the *brilliant idea* with which he was seized; some civilians who had been arrested were compelled to sit on chairs out in the middle of the street of a village during an attack. He states: "On their part, pitiful entreaties; on ours, a few blows from

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the butt end of the rifle. . . . At last they were all seated outside in the street. I do not know what anguished prayers they may have said, but I noticed that their hands were convulsively clasped the whole time. . . . The flank-fire from the houses quickly diminished, so that we were able to occupy the opposite house and thus to dominate the principal street. . . . Later on I learned that the regiment of reserve which entered Saint-Dié further to the north had tried the same experiment. The four civilians whom they had compelled, in the same way, to sit out in the street, were killed by French bullets. I myself saw them lying in the middle of the street, near the hospital."

In the tenth chapter are reproduced reports relating to the murder of civilians and the cruelties inflicted on the civil population by German troops; these reports conclude the present historical record of the acts of infamy charged against the German troops, which acts must remain for all time an indelible stain on the character of the German nation.

W. A. J. O'MEARA.

RUSSIAN SELF-TAUGHT.

By MAJOR C. A. THIMM; *revised by* J. MARSHALL, M.A., late of Petrograd.

(E. Marlborough & Co., Publishers, 51, Old Bailey, London, E.C. 5th Edition. Cloth, 2s. 6d.; paper, 2s.).

THIS is another of the "Self-Taught" series which the publishers have placed on the market and is in every way comparable in excellence to the others. It contains Naval and Military vocabularies and phrases, and will prove of much use to sailors and soldiers and others in touch with Russia at the present time, while to the general reader it will be of great assistance whether studied privately or in classes. It contains—Vocabularies, Elementary Grammar, Conversations, Naval Talk; Naval, Military, Commercial, and Trading Terms; Cycling, Photography, Shooting, Fishing, Money, Weights, Measures, Illustrations of Coinage. It is handy in form, easily carried either in kit or pocket.

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NOTICES OF MAGAZINES.

JOURNAL OF THE BRITISH SCIENCE GUILD.

The British Science Guild published the first number of its journal in September last. This journal contains a report of the Ninth Annual Meeting of the Guild which was held on the 1st July last at the Institution of Electrical Engineers and also an address on "The National Organization of Science" by Sir William Ramsay delivered on the same occasion. The subject of the address is one of considerable importance to the nation just now, as it deals with the problem of the utilization of our scientific resources of all kinds in the interests of the particular needs of the country at the present moment as well as for the promotion of the general welfare of the nation as a whole. Sir William touches upon the offer made by the French Académie des Sciences to the French Government on the 4th August last year to place all its resources in aid of the national defence and refers to the various committees which were born of this offer. An outline is also given of a draft scheme prepared by Lord Sydenham, one of the Vice-Presidents of the Guild, for the organization of the Royal Society to meet the exigencies of the War, and the hope is expressed that when peace comes the organization in question will not be allowed to lapse. The scheme proposed by Lord Sydenham provides for the establishment of a General Advisory Committee, to which all Departments of State would be directed to apply for assistance in regard to new inventions, improved methods of manufacture; and imposes the duty on this General Advisory Committee of making suggestions to the head of any Department of State in regard to questions of applied science.

In passing it may be stated that the British Science Guild was founded: "To convince the nation of the necessity of applying methods of science to all branches of human endeavour, and thus to further the progress and increase the welfare of the Empire." In order to attain its objects the Guild has pursued the policy of opening very wide the door to its membership; it has been fortunate in receiving the support of many eminent men belonging to almost every intellectual sphere of activity, consequently although the Guild is still young—it was founded in 1905—by virtue of the ties created in influential quarters it has already succeeded in doing much for the benefit of the British public; the Guild is deserving of all the encouragement those interested in the introduction of scientific methods and management in every sphere of our national activities are prepared to give it and more specially so in the direction of increasing its membership.

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REVUE MILITAIRE SUISSE.

60th Year. Nos. 7, 8 and 9 (July, August and September, 1915), with Supplement.

No. 7.—July, 1915.

INDEPENDENCE AND NEUTRALITY.

Le Devoir Suisse.

The article, which was commenced in the number of the *Revue* for the preceding month, is concluded in the number now under review (*vide R.E. Journal* for September, 1915). A fourth reason is given for the observance of a strict neutrality on the part of the Swiss during the conflict now in progress between the great European Powers; the Treaty of Paris, it is pointed out, expressly imposes a duty on Switzerland both towards the remainder of Europe as well as towards herself to remain exclusive and independent, so far as concerns external influences, put briefly, "*c'est notre indépendance de toute influence étrangère.*"

The *question des étrangers* had become a vexed national problem previous to the outbreak of the present war, indeed, the Press references to it date back 10 years and more. In 1914, the foreign element in Switzerland equalled about one-seventh the total population of the Republic; there were over 104,000 Germans in Zurich and Bâle alone, about 63,000 Italians in Geneva and the Ticino Canton, and over 37,600 French in Geneva. In consequence of this foreign intrusion a fear existed in some quarters that a fate similar to that which overtook the Transvaal might be in store for Switzerland, specially in view of the political influences at work in the foreign colonies and the power of their Press. The author expresses the opinion that the German peril had completely hypnotized the Swiss; this peril was no doubt the greatest which threatened the nation, but two other dangers there were, which also required to be dealt with. It is suggested that the Swiss should endeavour, during the present crisis and even in the future, before taking sides, to place themselves completely outside foreign influences and to purge their Press also of these same influences. It is pointed out that the foreigners who are now partaking of Swiss hospitality must in the ordinary course of intercourse with the citizens of the Republic, consciously and unconsciously, exercise a certain influence on them by their conversation, expressions of opinion, etc.; further, primordial interests dictate to the belligerents the adoption of measures to win over the opinions of neutrals in favour of their cause. Among the residents in Switzerland there are foreign propagandists who make use of two means to gain their ends: they endeavour to create a schism between the French and German elements composing the Swiss nation, they spread false reports and give an untrue representation of passing events. "Let us be on our guard to-day, for to-morrow it may be too late," says the author. He quotes the following views of M. Georges Wagnière: "There is another form of danger which the War has revealed to us; that is the *opinion étrangère* which has taken root throughout Switzerland and ousted the *opinion nationale*. Everything is now

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judged by the mirror reflecting the opinions of foreigners, 'tis so even in matters affecting the Fatherland. And in espousing all the sentiments of the foreigner, his ambitions, hate, bitterness, the fatal mistake is made of adopting just those ideas which hatred always blindly engenders. From that time our opinions lose all their value: they become deficient of that single quality which renders an opinion of value, that is the independence of him who gives expression to it."

It is urged that so long as the War should last, the national interest demands that the Swiss should suspend, or at least reduce to as narrow limits as possible, intellectual intercourse with foreigners, and particularly with foreign universities. The adoption of this course is held to be essential for the protection of the national *indépendance intellectuelle.* It is argued that in France, Germany, and Italy, the universities, the schools, the reviews have become hotbeds of propagandism; the most eminent authors and professors have taken up belligerency with great zest, and unfortunately their opinions carry the full weight of their authority on the minds of the Swiss people. It is urged that the belligerents should be furnished by Switzerland neither with the ideas likely to be conveyed by an argument nor with arms—certainly not for use against themselves.

The opinion is expressed that in regard to the present crisis the Swiss Press is in a state of moral bankruptcy; it ought to have striven to form and guide public opinion in the interests of the country as a whole; it is alleged that, on the contrary, it has divided the nation and too often forgotten the true interests of the Republic.

The German section of the Press was the first to go wrong; it took up the Teuton cause with the ardour of a belligerent. The French section of the Press had a more correct view regarding national interests; it expressed the fear that a complete victory of the Germanic Powers might involve at first the economic absorption of Switzerland only, and later also the loss of its political identity. It is stated that the hatred of all things of German origin has gone beyond reasonable limits and that the reaction against "*Prussian militarism*" threatens to be converted, in a word, into "Antimilitarism."

The Press of a country, it is pointed out, is by the ordinary individual held to represent public opinion; therefore the more unanimous, the more judicial and the more scrupulous that the Swiss Press is, the greater will be the power of the Central Authority to ensure respect for the neutrality of Switzerland and to protect the national interest.

Yet a fifth reason is put forward why Switzerland should maintain her neutrality: her *mission internationale* imposes the adoption of this course on the Swiss people. The accomplishing of great international duties is an honour to her citizens and the justification for the existence of the Republic; it is only by attending to these duties that Switzerland can hope to retain the absolute confidence of the belligerents. The maintenance of the neutrality of Switzerland is required in "the interests of entire Europe"; it is for this reason that Swiss citizens can busy themselves not only in the domain of philanthropy, but also in the intellectual and moral spheres of activity. The Swiss, it is stated, should strive resolutely to obtain the full benefit arising out of impartiality of conduct; they should avoid being attracted in one direction or another

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either by affinity of race or common origin of language. What is most wanted is that the citizens of the Republic shall, at the same time, strengthen in themselves the *esprit suisse* as well as the *esprit européen*. The identity between the national interest and the European interest imposed by the Treaty of Paris should at no time be lost sight of, it transforms the neutrality of Switzerland into a *neutralité positive*, even in relation to the obligations which are superficially the most negative. A correct understanding of these obligations will cause hate and preferences to be dismissed, the heart to be elevated and the mind to be illuminated.

Consideration must at all times be given to the future. The question is asked: "Will the present war spare us?" The hope is expressed that it will do so, but of this no one is absolutely certain. The situation has not changed appreciably since August, 1914, and from Porrentruy and from Basle the smoke of battle can be seen and the sound of the struggle heard, and now that Italy has entered the conflict Switzerland finds herself surrounded by fire; she is indeed in the very vortex of the storm. War is ever present to the nation and arms must ever be kept in a state of readiness for instant use.

A period of supreme danger may supervene for the Republic when the date for the settlement of the accounts between the present disputants is at hand. This period will, it is suggested, be a more dangerous one for Switzerland than that of August, 1914. It is just possible that, at the conclusion of the present conflict, new quarrels may arise outside which it may not be so easy for the Swiss to keep as has been the case as regards the existing struggle. It is expected that after the War great economic groups will be formed by the European nations, one or other of which Switzerland, it is thought, will be invited to join, and, indeed, will be compelled to join if national extinction is to be avoided.

The present situation would, it is stated, be clearly understood by the Swiss if they possessed but a little of the *sens historique*; if they understood the history (which the great Swiss Jean de Müller calls "A storehouse of experiences available for use in dealing with questions of high politics") of their nation, the good citizens would realize that their country is not some abstract idea, that its neutrality is not something residing outside the limits of time and space. Switzerland is a State like others, but being situated at the centre of Europe it is in close contact with the great nations of the Old World, which are tending to crush the Republic merely by their potential weight. Switzerland has never succeeded in keeping herself entirely free from entanglement in the conflicts which have torn Europe in the past; these conflicts have at times enmeshed her last of all, sometimes only indirectly, but the fact remains that on every occasion that a considerable European disturbance has occurred the end has not been reached without drawing Switzerland into the influence of the storm. History teems of examples in this respect. Switzerland indeed was born of the tumult of the Middle Ages, the "emancipation of the communes." The Union of the Waldstätten may be regarded as an episode in the struggle between the Guelphs and Ghibelines. Switzerland was divided at the Reformation, disturbed by the Thirty Years War, stained by blood at the Peasants' Rising, and she has had her frontiers violated by Mercy and by Prince

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Eugene. If in 1792 and in 1793, she was, to a considerable extent, spared at the time of the French Revolution, nevertheless, in 1798 and in 1799, the armies of the Directory trod her sacred soil which also became the theatre of the European War. The opinion is expressed that the cruelties perpetrated by German troops in Belgium, in connection with the present war, are no more barbarous than the bloody exploits committed in the Petits Cantons by the XIV. (French) Demi-Brigade composed of released criminals, whose memory has remained a ghastly nightmare in the little Republic ever since the foundation of the Swiss nation. To add insult to injury the generals and soldiers who had violated Swiss neutrality, after having admitted it, did not cease to proclaim her neutrality aloud in the name of universal liberty, equality and fraternity, and even to claim that they had freed the Swiss people. Finally, from 1813 to 1815, foreign troops were once again seen within the territories of the Republic, when fresh trials had to be suffered by its citizens during the last war of Napoleon.

In conclusion, the author of this paper puts on record his own articles of faith; these are too numerous to reproduce here *in extenso*. The following are examples:—

"We have no right to sacrifice the Fatherland to our egoisms, to our individualisms, to ill-defined generous feelings, to mere ideas, however noble they may be. To an idea we may sacrifice but our own selves."

"Work for the Fatherland, this is the surest means of working for the whole human race."

"By being good Swiss, we shall also be good Europeans. We can be that without uppishness and conceit, without finding it necessary either to prophesy or to anathematize."

"It is not war which is impious but hate."

"To work in silence will be our salvation."

"A country is defended by two forces: its army, the exterior force; the patriotism of its people, the interior force."

"The Swiss people are sovereign; each citizen is a member of this sovereignty: each citizen therefore must bear his share of responsibility."

"This responsibility necessitates the performance of obligations before pressing for rights; it requires submission to civic and willing discipline analogous to military discipline."

"A country must not only defend, but also justify its existence."

"The Treaty of Paris guarantees us nothing in itself: a scrap of paper can never have the strength of a shield."

"If we wish to remain neutral—and we do so wish—let us accept all the obligations of neutrality without reserve."

"An individual cannot at the same moment be French and Swiss—German and Swiss—Italian and Swiss."

"The love of Fatherland is imperious, exclusive."

"Patriotism is not a debatable subject, because it is not possible to debate one's duties."

The final recommendation is that the Swiss people should, at the present time, adopt for their motto the injunction contained in the following line by Corneille:—

"Let us do our duty and let the gods do theirs."

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FRENCH MILITARY REGULATIONS CONSIDERED BY THE TEST OF ACTUAL WAR.

The hostilities which commenced last summer in Western Europe had long been awaited; consequently, the French Army was not taken by surprise, sudden as was the outburst which has involved the greater part of Europe in a devastating war. The imminence of the danger having been apparent to all eyes, preparations had been continuously in progress in France to meet it, and therefore her army was not called on to act against the foe in accordance with rules and regulations relating to field operations which were out of date and otherwise unsuitable of application under modern conditions of fighting. The French regulations on the subject, on the contrary, were of recent date, and those who had been responsible for their compilation were, on the outbreak of war, called upon to apply the maxims laid down by themselves in actual practice. Thus, it has been possible to obtain the maximum advantage therefrom. A critical examination of the French regulations follows, a commencement being made with the Decree of 28th October, 1913, which was drafted by a commission of military officers and deals with the operations of the larger formations or units. This Decree was but 10 months old when war broke out; the General Staff of the French Army was naturally aware of its general tenour, and the generals in command of the larger formations had had sufficient time to grasp the inner meaning of its contents, but enough time had not yet elapsed to allow them to forget the lessons therein contained.

The systematic silence maintained with regard to the operations which have been taking place since August, 1914, naturally renders it difficult for an investigator to be fully cognizant of all that has been happening; the truth is only known partially and even then in a disconnected form. The deepest ignorance prevails, even in well-informed quarters, in relation to many important facts; many others have been so twisted and turned—in some cases unconsciously in others by set purpose—as to bear no longer any impress of their true image. For the foregoing reasons, it is impossible to penetrate sufficiently deeply into the principal events of the War for the purpose of laying bare in all their nakedness the shortcomings of the regulations under consideration; all that can be done at the present time is to put forward a few notes, of a more or less summary nature, which may be of use when the Great Inquest, which must of necessity be opened after the termination of the War, takes place.

The Operations of Large Units.

The decree of the 28th October, 1913, deals with the general principle of strategy, and as the larger movements of armies cannot be hidden from public knowledge and their main object can, in some measure, be understood even by laymen, the remarks in the preceding paragraph do not apply to the contents of this Decree.

Generally speaking, it is for a government alone to determine the political object of a war. This truth seems to be a veritable truism and it is asked, therefore, whether under these circumstances any reference thereto should exist in a guide prepared exclusively for the use of divisions, army corps, armies and groups of armies. On the other hand, it is certainly a mistake to allow the civil authority to decide which

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body of troops it is to whom the term "*principal*" *adversary* is applied in the decree aforesaid. On the commencement of hostilities the question immediately arises: Who is the "*principal*" *adversary?* Is it that nation or body of troops which is considered the most formidable either by reason of its numbers, or the skill of its generals, or the superior power of its engines of war? On the other hand, is it the one who, in the general interests of the situation, must be knocked out first?

It is rightly concluded, that there must be a complete understanding between the two authorities, civil and military; for instance, it is for the Central Government to indicate the political and social considerations which must be borne in mind, and for the military authorities to see to it that their plans conform thereto and meet the requirements of the general situation. The execution of the military plans then proceeds automatically; the army to which the objective has been clearly indicated, is in a position to decide on the methods by which the end in view can be attained, and it only remains for the Central Government to provide the wherewithal necessary for the purpose of the war.

The first paragraph of the decree referred to states:—"If a campaign is so widespread as to effect more than one frontier, the Government will designate the *principal adversary* against whom the largest portion of the national forces should be directed. It allots, in consequence, the troops and resources of every kind and places them at the sole disposition of the generals commanding-in-chief in the several theatres of operations."

In Germany, where the civil authority is submerged in the military authority, the important question requiring a decision at the beginning of the present war was which of the two, Russia or France, was really the *principal adversary*. It is now known that there was hesitation in high quarters in Berlin to give a definite pronouncement on this important matter, and the distribution of the German forces, which was made at the beginning of the War, has since been modified more than once, and even at this date a state of stable equilibrium has not yet been attained.

France had no choice, she placed under one general the whole of her forces and he has had them at his *entire disposal*. It is alleged that when the Government wished to withdraw a small part of these forces for employment in another theatre of operations, it came into conflict with the generalissimo, who, under the paragraph of the Decree quoted above, was acting strictly within his rights.

The provisions of the paragraph quoted above seem therefore out of place; it would appear that no civil authority, competent enough to advise on the political significance of the terms of this paragraph, was consulted. Had this been done such a civil authority would, it is presumed, have pointed out that the Central Government must possess the power to intervene at any moment, since the general situation, internal as well as external, is liable to modifications and alterations instant by instant. The attitude of the nation and the intentions of foreign states are as changeful as the designs in a kaleidoscope. The periodical reports of diplomatic representatives and of provincial officers can and must exercise an influence which reacts with considerable force on military operations. It naturally behoves the government of a country to act with great circumspection in dealing with a military situation; it must not meddle with it every minute. Only when some far-

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reaching change in policy is necessary should it intervene; otherwise the government should leave matters in the hand of the military chief, so long as he is not so much left alone as to be constituted a veritable dictator.

It is held that the objections to the provisions of paragraph 2 are not any less open to objection than those of the first paragraph of the Decree. It contains a qualification of doubtful value. The main provision thereof runs :—

"Military operations contemplate the complete destruction of the organized forces of the enemy."

The qualification is expressed in the following terms :—

"This principle, which is of an absolutely rigorous application in the principal theatre of operations, is subject to exceptions in those secondary theatres of operations where an immediate decision is not being sought."

The leading principle of the above paragraph is based on a theory of Clausewitz which has served its time. The object of war is to obtain the victory, and this can be brought about by crushing his army; it can, however, be obtained in other ways; by putting his army *out of action*, by obliging it to consume munitions and food faster than supplies can be renewed, by reducing his country to a state of famine, by creating demoralization and tumults among his people; any one of these means may bring the enemy on his knees to seek peace. It is the enemy's *power* which must be destroyed, not necessarily his *army*. It is stated that the conception of a triumph won by prowess of arms, and that alone, is a purely military conception.

The world is revolving at a time when a generalissimo has to be satisfied with "nibbling"; he has to give up the idea of taking big bites!

The injunction contained in paragraph 3 of the Decree has proved abortive: by it the commander-in-chief is exhorted "to seek a decision *within the shortest limits of time*, in order to terminate the campaign promptly."

True to the precepts contained in the last quotation, the Germans have pushed their offensive hard; however, their efforts are tending to prolong rather than to shorten the War. The French are proceeding on similar lines.

The present war is proving more than ever before that the preponderance of numbers tells. But the situation in France seems to indicate that the first duty of the country should be to take care that no more men are called out for service with the colours than can be immediately utilized. Pursued by the obsession for numbers, it is said that, by degrees, every man capable of military service has been called up, causing the rest of the population to be left in a state of chaotic disorganization.

The official maxims of war adopted in France are laid down in paragraphs 4 to 9 of the Decree of 1913. The offensive is preached therein with great persistence :—

§ 4. "The decisive battle, sedulously sought for from the commencement, is the sole means whereby the initiative of the enemy can be crumpled up and the destruction of his armies effected. It constitutes the essential act of war. The conquest of a part of his territory, the capture of fortresses, can never alone ensure decisive results.

"Strategic combinations consequently have for their objective, above all things, the adoption of measures to compel the enemy to accept battle."

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However, what if he refuses battle? It is well to remember the retreat of the Russians to Moscow before Napoleon when the Great Emperor was "defeated by his very conquest."

§ 5. "In order to conquer, it is necessary to break up by force of arms the enemy's battle formations.

"This breaking up of his formations demands persistent attacks, well pushed home without any consideration as to the cost: it can alone be obtained at the price of enormous sacrifices. Every other idea on the subject must be put aside as being contrary to the nature of war."

In the present war, both French and Germans have played up splendidly to the principles inculcated above. But nowhere has the front been broken through permanently; at most, the fronts have had nicks made in them of no considerable depth, and here the damage done has been quickly repaired in the same way that a cicatrice quickly forms to close a slight open wound in the flesh.

§ 6. "The offensive alone produces positive results. In war, success has always been on the side of the generals who have wished for and sought battle; those who have waited for it have always been beaten.

"In taking the initiative in operations, a commander imposes his will on his foe instead of having the latter's will forced on him. An energetic commander-in-chief, full of confidence in himself, in his subordinates, in his troops will never suffer his opponent to open the battle. . . ."

The spirit of the French regulations cannot be more clearly exposed than is done by the preceding paragraph. The Campaign of 1812, already recalled earlier, shows that success in war has not always been on the side of commander who has wished for and sought battle. In taking the initiative by attacking a strongly fortified position, a commander, at times, falls into the trap set for him by his adversary. The truth is, the offensive increases the dangers which one's own troops run as well as those which the enemy is made to run. The question to be determined is whether the increase in one's own vulnerability resulting from the adoption of the offensive is more than balanced out by the increase of effectiveness obtained thereby. Clearly, sometimes the balance of advantages will be in favour of the offensive, at others against it. The mistake lies in adopting, *a priori* and without taking all the factors into consideration, a settled conviction in favour of one single mode of combat to the exclusion of every other, thereby the mischief is done of inculcating a formal dogma.

The view is expressed that having regard to the French temperament, instead of urging on them the offensive, it would have been wiser to have prepared them for the waiting game which the necessities of the situation has now forced on them; the wonder is that the ardour of the French has not cooled and that they still retain full confidence in themselves, in spite of their past training and education.

The qualities, indicated above, which have been shown by the French troops are the contrary of those expected by the authors of the Decree of 1913, as disclosed by their report to the Minister of War; *inter alia* they state:—

"The conduct of war is dominated by the necessity of giving a vigorously offensive impulse to the operations.

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"Among the nations of the world, it is France which in its military history affords the most striking examples of the far-reaching results to be obtained in the conduct of war in an offensive spirit, and of the wholesale disasters which follow in the train of a defensive war.

"Raised by us to a state of perfection, the doctrine of the offensive has brought us the most glorious successes. And, by a cruel counter-proof, the day on which we have neglected it, it has furnished, there and then, to our enemies the weapon by whose aid they have defeated us.

"The lessons of the past have borne fruit; the French Army, having reimbibed its former traditions, no longer recognizes for the conduct of operations any other law than that of the offensive."

The authors of the report in question refer therein to the views which prevailed after the South African War as to the impregnability of a defensive front and of the possibility of bringing about decisive results by manœuvre alone and without combat, and to the *coup de grâce* given to these "*dangerous theories*" by the lessons of the Russo-Japanese War. As might be expected, it is pointed out that in war all the decisions of the higher command must be inspired by a desire to seize and maintain the initiative; further, that this desire for the offensive must be pursued without relaxation, in spite of all obstacles and inevitable accidents. The theory is correct enough, so long as it is not pushed to absurd lengths; useless sacrifices must be avoided at all costs.

In paragraph 6 of the Decree very properly nothing was said, as has formerly often been the case, that the fate of a campaign depends on the results obtained after first contact with the enemy. The expectation contained in this paragraph that "in every case the first battles are of great importance in view of the preponderating influence which they may exercise on the succeeding course of events" the experience of the present war has, fortunately, proved to be somewhat wide of the mark, having in view the sense in which the foregoing language was employed. The result of the fight at Charleroi certainly exercised a great influence on the succeeding course of events; and also provoked a proper wish for revenge, of which the victory of the Marne may be considered the first-fruits.

True to its faith in the "*decisive battle*" the regulations relating to the operations of the large units are naturally concerned with the "supreme struggle which decides the fate of the War and the future of the nations hanging in the balance." In paragraph 7 are given the conditions necessary to ensure success; it is laid down that all available forces must participate in the fight. These forces cannot hope to obtain success unless the commander and his troops are confident of victory and possess the firm desire to obtain it, cost what it may (para. 8). Once victory is obtained, it must be completed and rendered decisive by "a pursuit executed without truce or relaxation and by putting forth all available energy even up to the breaking point"; it must end in the annihilation of the hostile forces (para. 9).

In practice, it has been found impossible to fight a *decisive battle*. As to the taking advantage of victory, the Germans certainly attempted to do so, to a greater or less extent, after the Battle of Charleroi, but the French were not in a position to do so after the Battle of the Marne.

The general principles set out at the commencement of the regulations

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are developed in Chapter VII., which deals with the operations of an army corps. It is there stated (para. 114) that "the decision to fight and even the general lines on which the collision shall be effected should be worked out previously to actual contact." This precept leaves out of account the movements of the enemy, the local situation, the atmospheric conditions. Such a procedure has never succeeded in practice.

The regulations also lay down the injunction that the higher commanders should never tell their subordinates, in some cases, that their troops have a secondary *rôle* assigned to them, and in others, a primary *rôle*. Such a precaution will, it is stated, prevent operations from being carried out smoothly.

In the report to the Minister of War already referred to occurs the following passage :—

"During the whole course of the action, the commander must at all times be *looking ahead ;* in the event of failure, all his efforts should be bent to the renewal of the combat and to the resumption of the offensive."

The doctrines laid down in the regulations have penetrated into the blood and marrow of the officers of the French Army ; these officers have repudiated all timidity, maybe even all prudence. The hard lessons of real war have taught them that fortune does not always smile on the brave and the bold, and that it is wise to have some regard for things behind them. They have become more circumspect with the progress of time, and, without losing any of their ardour, they have finished by realizing that there is no reason on earth why the effort put forth by them and their troops should not be proportioned to the results desired. To divert the enthusiasm of the warrior into suitable channels is by no means the same thing as to destroy it. For this reason it is wrong to develop the offensive spirit exclusively, to push it to extremes regardless of the demands of the situation ; however, such is the dominating theme which has inspired the regulations for the operations of large units.

The contents of the Decree of 1913 were intended to serve as a guide to the Staffs of the Army for the preparation and execution of schemes in connection with manœuvres and war games ; the maxims contained in this Decree further laid down the doctrine on which the instruction in the École Supérieure de Guerre, as the centre connected with the higher military education of officers must *compulsorily* be based ; finally, this doctrine constituted the framework on which the field service regulations of the French Army were built up.

The artisan is judged by the quality of his work ; the results obtained by him indicate the value of the theories put into practice by him. The experience of war is the most telling of all tests in proof or disproof of any particular theory, though admittedly faulty application of a theory naturally does not necessarily completely vitiate it, but only modifies its efficiency factor. The truth of a dogma is unaffected by the errors of the doctors who discuss it or the wrongheadedness of the faithful disciples who interpret it in a contrary sense. Having formulated this reserve, it is held that, since in less than a year after the rules drawn up in 1913 by the French Conseil Supérieur de la Guerre were approved, the test of war has shown them to be defective only goes to prove that this body was fallible, after all, like all other human institutions.

The Commission, responsible for the terms of the Decree, laid it down

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as a principle that an army corps should at all times operate by complete divisions. It explained in its report that "it wished to set its face against the systematic employment of mixed bodies of all arms to which the appellation *groupements momentanés* had been applied. The latter groups can at times be effectively employed in certain cases where the country is enclosed or provided with much cover; but the employment of such groups leads to a disruption of tactical cohesion and to a discontinuity of effort."

It is pointed out however that in every part of the theatre of operations, from the commencement of the War to the present time, the commanders (of the French Army) have continuously formed groups of this kind in order to carry out operations which have been decided upon from time to time. Every time any particularly hazardous enterprise has had to be carried out the generals commanding such forlorn hopes have been willingly given *carte blanche* to constitute their commands so as to meet the special requirements of the situation; the question of tactical cohesion has had to take care of itself, no hesitation has been shown in disregarding the most recent and formal of the rules having official sanction.

NOTES AND NEWS.

Portugal.—A special correspondent points out that some excitement has been caused in Portugal by the publication of a sensational brochure. It is from the pen of a distinguished diplomat. The work bears the main title, "Contribution of a Page to National History," the sub-title being "Portugal before the War."

The brochure does not deal with any military matters of a technical character, but it touches upon questions closely affecting the Defence of Portugal, and has therefore excited considerable interest in the Portuguese and foreign Press. In an extract taken from the brochure it is stated: "Soon after the declaration of the present war in Europe, the several chancelleries published official correspondence in relation to the great events in progress.

* * * * *

"Ten months have passed by since the first negotiations took place between the Portuguese and British Governments on the subject of our attitude to the latter country and in relation to the European conflict and up to the present public opinion in Portugal has not been enlightened on this important matter by the publication of a single official document.

"Portugal has not yet denounced her neutrality, although in Africa, at Naulila, German troops have invaded our territory and, after a sanguinary combat, have taken some Portuguese officers and soldiers prisoners who still remain in German hands.

"These facts indisputably constitute a state of war, logically and inevitably implying a rupture of diplomatic relations to which effect should have been given without a moment's delay. Nevertheless, the German ambassador is still resident at Lisbon and the Portuguese ambassador at Berlin.

* * * * *

"The European War is essentially a political fact. On one side, a fight is in progress for liberal ideas tending towards a general transformation of human relations; on the other, the defence is in hand

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of reactionary ideas consisting of dogmas resisting every programme of emancipation. Ranged up on one side is democratic Europe, on the other feudal and apostolic Europe. The European War has divided opinion in the neutral countries of Europe into two perfectly distinct camps. The reactionaries adhere to Germany's cause, they see in the triumph of German Imperialism the defeat of liberal ideas; advocates of liberalism cling to the cause of France and Great Britain. In our case, the great majority of the nation has given its adhesion to the cause of the Entente Powers, but the conservative element and the reactionaries of the political and religious worlds have bound themselves hand and foot to the cause of the German Empire.

"The fallen Royalists place all their hopes in the success to German arms, therein they think they perceive the best chances of the re-establishment of a monarchical feudalism in Europe and, for Portugal, the guarantee of a new monarchy supported by the Imperial power of the Hohenzollerns, a guarantee which is not forthcoming from the British Government."

It is stated by the special correspondent that, in August, 1914, Portugal offered Great Britain her co-operation, but that the former's military resources were at that time held to be insufficient: soon afterwards, however, Great Britain expressed the wish to have the co-operation of Portuguese Artillery, but the Portuguese Minister for War felt that the susceptibilities of the other arms of the service would be wounded if the artillery were treated exceptionally; that is to say, he wished to send a completely organized unit of all arms. His views being unacceptable, guns were eventually despatched but no *personnel*. The view is expressed that the adoption of this step has converted Portugal into a clandestine depôt of war materials for one of the belligerents and, therefore, to clear up the international position of Portugal and to have everything above board, it is necessary for the Portuguese Government to return to the ambassadors of the Powers at war with Great Britain their credentials and passports.

INFORMATION.

Switzerland.—A military wrist watch, known as the "Madix," is illustrated and briefly described. It is provided with a double face glass, the exterior surfaces of which are concave, and not convex as is usually the case; the case is also of stronger design than that supplied to ordinary wrist watches.

This number concludes with bibliographies relating to the War, and other publications of military interest.

No. 8.—August, 1915.

IMPRESSIONS OF GERMANY.

The Army on a War Footing.

The German Army, in the year of grace 1915, has been found by those who have had the privilege of a close acquaintance with it in the piping time of peace just what one would have expected; an army trained above all things for the prosecution of war. The experiences gained during the early battles have caused a modification to be made with regard to certain tactical principles, but in other respects matters remain as in pre-War days, down to the smallest details, and orders are being executed at the Front in the same calm and confident manner as they were executed in garrisons, prior to August, 1914.

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The German Army was completely ready to pass from a peace footing to a war footing without having to undergo the radical changes which have had to take place in the cases of the armies of its opponents, where improvisation has had to meet the deficiencies due to a lack of preparation.

The Man.

The Soldier.—The soldiers of every arm look healthy and strong; they are correctly dressed and smartly turned out. Noisy and drunken men are not met.

Bearded reservists, between the ages of 25 and 35 years, are by far the most numerous class; there are a few volunteers under 20 years of age in the ranks. The landsturmers have rolled up particularly well. The men back from the Front look tired; they are sunburnt and their dust-covered uniforms have lost their original colour. These men disembark from the trains in silence; much respect and sympathy are shown them by the crowds at the station.

Soldiers proceeding to the Front are accompanied to the railway by their relatives; they are saluted by the bystanders, but no cheering or other demonstration takes place. So far as the Guard Corps is concerned the men are of fine stature, with intelligent features, they possess physical strength without any sign of coarseness; in other corps, on the other hand, there are many "dumpies," and men of low intelligence.

The recruits of the 1915 class are still dressed in the old deep blue uniforms, and their presence in German towns creates an impression that ordinary peace conditions still prevail. In Berlin more men are now seen in uniform than was the case in peace time, and the constant marching to and fro of the troops, with bands playing, creates the impression that nothing has changed in the capital; this has had a very reassuring effect on the civil population.

The opinion so frequently expressed that the German soldier is lacking in *initiative* and only shows courage when acting in masses and under the eyes of his chiefs is held to be defamatory. At the Front, the quality of the initiative possessed by the individual soldier has been much developed since the beginning of the War, in witness whereof stand the results obtained by patrols. All true soldiers appreciate the sterling qualities exhibited by the German soldier, his unshakable confidence, the sacrifices he has made.

The N.C.O.'s.—Reserve regiments commenced the campaign each with from 50 to 60 N.C.O.'s of the active army; the remaining N.C.O.'s were drawn from the Reserve. The heavy losses suffered by the German Army have naturally increased the proportion of the latter class of N.C.O.'s in the units. The German N.C.O. is a most valuable asset, the unchallenged prestige which he enjoys is directly due to the position he has made for himself in the army. Within his own domain his authority is absolute; his experience assures him the respect and moral support of his officers, who often, it may be said, seek his views. In peace time, the value of the reserve N.C.O. in no way approached that of the professional N.C.O. War has altered all this; the reserve N.C.O. can now become even an officer.

The Officer.—The junior ranks have outwardly altered considerably. The present-day elderly lieutenants and first lieutenants, with their heavy figures, look out of place. Practically the whole of the company

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commanders and subalterns of the active army were wiped out in the first battles of the War; officers of the Reserve and promoted N.C.O.'s are filling their places.

The old prejudices against the officer of the Reserve have been killed by the War; he is now in the majority and doing his duty manfully. The War has brought about a democratization of the officer corps; the privations and dangers met with in common strongly binds the officer corps together, in spite of the many social differences which exist.

The strong caste feeling, which has so often been held to be a reproach to the German officer, is, after all, nothing more than a highly developed type of *esprit de corps*.

Discipline.

Discipline is strictly maintained, in respect of even trifling matters, alike in the case of the landsturmer as of the recruit, aged 20 years. The highest conception of duty prevails everywhere and in every branch of the service. The German officer is too intelligent a person not to realize the importance of the moral education of the soldier; he knows how to appeal to the heart of his subordinates, to their *amour-propre*; and he does so without the use of extravagant language. The German regulations lay down rules for the conduct of the officer towards his men, he is reminded that: "The constant solicitude for the welfare of his men is one of the highest privileges which an officer can enjoy." The latter is enjoined to be the faithful protector, who should share in the joys, anxieties and privations of his men, thus to gain their full and entire confidence.

A visit to the Front provides ample evidence that strong bonds of affection, based on respect and confidence, exist between officers and men of the German Army. The number of acts of devotion done on behalf of their officers by the men has been increasing almost daily since the War began.

A feature of the discipline of the army is the instantaneous manner an individual in a unit thereof makes the quick change from a state of the most complete laxity in his general conduct to that of the most absolute rigidity, a change which amounts to automatonism.

The battle discipline of the German Army is splendid. Germans do not confound the march of men, elbow to elbow, which is a form, with cohesion which is a mental state. An extended formation may occasionally favour cohesion far more than a formation in serried ranks. French and British journalists often speak of the mass formations used by the Germans in their attacks, and the public imagine that by this is meant that divisions and army corps advance in slow step and with bands playing under a devastating fire; indeed, as did d'Erlon's Corps at Waterloo. References to "Mackensen's phalanx" recall Ancient Greece and Philip of Macedonia to mind; 300,000 men advancing 32 ranks deep to be mowed down by the "75" gun; what a splendid display for a cinematograph film! The real thing is quite different: "the attack in deep masses" spoken of in the Press, is nothing more than an attack in which depth is the essence of the formations employed, consisting of echelons in reserve marching sufficiently close to the first or firing line so as to be in a position to reinforce the latter in good time. The echelons in rear remain in close formation, so long only as they are not under hostile fire.

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The successive lines of attacking infantry, which always follow close behind one another, seen from their enemy's position have the appearance of a compact mass. In time the successive lines merge into one another as they get close to their objective, and this feature of the attack it is which has given rise to the legend that a revival of the ancient phalanx has been brought about by the Germans.

It must be borne in mind that the Germans put greater store on the reinforcement of the firing line in good time and on the maintenance of the correct direction than on the avoidance of obstacles and the minimizing of losses. "Advance at all costs" is the overriding consideration laid down in the German *Field Service Regulations* as a maxim for the guidance of commanders in the field. Blind adherence to the principles contained in these Regulations has no doubt been largely responsible for the very heavy losses suffered by the German Army in the present war.

In the Trenches.

At first sight, the German trenches create the impression of a vast labyrinth of ditches and drains, crossing one another at all angles, which appears to possess considerable depth horizontally. Later, the fact strikes the observer that there are really two or three parallel lines of trenches which are interconnected by communication ways. Behind the whole are support points, consisting of villages and isolated farms which have been carefully fortified.

The First Line Trench is by far the strongest and most completely organized. Its trace is sinuous, all angles being carefully avoided, and follows the contour lines of the ground as much as possible. It is by the trace of the trenches that the traverses along it are formed. The depth of the trench is as a rule about 6 ft. 6 in.; the bottom is generally paved or covered with a wooden grating. The side of the trench nearest the enemy is perpendicular and revetted with watling; sandbag loopholes are provided, and in many cases steel shields, obtained from the siege artillery, have also been fixed along the parapets. The exterior slope has a gentle slope, the parapet having a thickness of from 6 ft. 6 in. to 10 ft.

Isolated Machine-Gun Emplacements are constructed in the form of small casemates provided with overhead cover consisting of timbers and earth (about 1 ft. 6 in. thick). The portholes are formed of sandbags and steel plates.

Observation Posts are provided in the line of parapets at suitable intervals. The important posts are provided with telephonic communication, and a periscope or a pair of Zeiss glasses (magnification 15).

The *niches* made in the parapets on the enemy's side of the trenches have been replaced by regular *casemates* along the opposite side of the trenches (*i.e.* with openings towards enemy). These casemates are large enough to hold 20 men and have overhead cover consisting of at least a 3-ft. thickness of earth; some of them are comfortably furnished.

Scrupulous cleanliness prevails everywhere in the trenches; many of these and their points of intersection have been named after well-known streets, squares, etc. Portraits of the idols of the German Army are to be seen everywhere in the trenches and in the casemates.

Obstacles extend along the whole front, at a distance of about 100

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yards from the trenches; these obstacles consist of barbed-wire entanglements, flanked and commanded by machine guns, palisading, inundations, military pits, etc., all are cleverly hidden from view. Corpses can still be seen lying about in the obstacle zone.

Saps are continually being driven towards the enemy's trenches, mines are often lodged at the heads of these saps.

At ordinary times, when the enemy is not busy, the German Infantry keep up a desultory rifle fire; 20 men per company being employed for this purpose, half of whom are provided with field glasses. The German musketry regulations lay greater stress on the necessity for accuracy of fire rather than on its volume. The men feel relatively safe in the trenches and therefore their fire is steadier and more accurate than when fighting in the open. The fusillade is intermittent; there are short periods of calm.

At intervals along the communication trenches there are *sidings*, in which the reserves are stationed. At certain places deep ditches, several feet deep, have been sunk in the communication trenches and have been bridged over; obstacles are placed at the bottoms of these ditches. In the event of a retreat taking place from the fire trenches the bridges are removed by the men who last pass over them; as machine guns have been installed to cover these ditches, in positions within 100 yards therefrom, a withering fire can be brought to bear on any of the enemy who dare to pursue as far as the ditches referred to.

In some cases, elevated observatories have been erected from which a view is obtained over a great extent of country.

Field guns are as a rule placed in emplacements about 1,000 yards in rear of the fire trenches, further in rear are located the field howitzers.

The *retrenchments* behind the fire trenches are not so substantial as the latter; they are roughly made, very little revetting having been executed in them; on the other hand, great quantities of wire entanglement have been constructed in front of them.

Troops withdrawn from the trenches, on completion of a tour of duty, are billeted in abandoned villages; after a short period of rest, such troops are drilled for several hours every day.

Questions Affecting Equipment and Stores.

The whole army is wearing the grey field service uniform, known as the *Feldgrau*. Even the Landsturm has been issued with this kit, except that it still retains the historic headdress, consisting of a black oilcloth helmet with a yellow metal Maltese cross as a badge, worn during the Wars of Independence of 1813. A cloth cover is worn over the black "Pickelhaube" helmets, but cloth helmets are now being issued to the troops, metal mountings still being worn with them.

Line of communication troops are armed with the Mauser, 1888 pattern, or with French rifles.

Detachments proceeding to the Front have completely new uniform and equipment issued to them. Considerable changes have been made in the dress and equipment of officers, in order to render them undistinguishable from their men at a distance. All the new uniforms are of stouter and stronger material than that with which the campaign was begun; it is also more expensive. The German soldier still wears the stiff half-Wellington type of boot worn in peace time.

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At the *Ordnance Depôts* not only are new articles of uniform and equipment stored, but, at many of them, repair shops have been established for renovating guns, rifles, wagons, etc., and also for converting equipment, etc., captured from the enemy, to render the same utilizable by the German Army.

General Remarks.

The dominant impression which a visitor to the German front carries away with him is the apparent calm which prevails there; things proceed as if the troops were merely taking part in grand manœuvres, it is only when the dead and wounded are seen that the fact is realized that the German Army is actually at war. A calm, bred of confidence, also reigns in rear of the army amongst the civil population. Neither the country nor the army are yet approaching any way near exhaustion, in spite of the alarming reports concerning the condition of Germany in the foreign Press.

HISTORY OF THE MACHINE GUN.

The history of wars and of weapons is as old as that of human races. From the earliest times much ingenuity has been expended in designing and fashioning engines of war. The sling and the bow and arrow have been used side by side with huge catapults employed to hurl stone projectiles. The invention of gunpowder gave a spurt to the manufacture of improved weapons of warfare, though at first the progress made was not commensurate with the importance of the discovery referred to; the fire of the old guns was slow and inaccurate. To overcome the disadvantage of slowness of fire, weapons were constructed having for their main object the discharge of a number of projectiles successively one after the other; in one case an iron tube was designed, permitting the rapid discharge of ten lead bullets. These bullets were inserted in the tube successively, each preceded by a charge of gunpowder; they were perforated with a small hole which was primed with sulphur, so arranged that the firing of the charge nearest the muzzle caused the ignition of each of the remaining charges successively by the flash from the sulphur priming in the bullet in front thereof; as each charge exploded it naturally propelled the bullet in front of it to its destination. Out of this developed the idea of the machine gun; the first weapon of this type consisted of two to four guns of small calibre mounted together on one and the same axle. The vents of these guns having all been primed, a red-hot iron bar was so placed as to come into contact with the priming in all the vents simultaneously; consequently, the projectiles in all the barrels were expelled practically simultaneously. It was towards the middle of the XV. Century that the "bullet pump" or "organ-gun," as it is familiarly called on the Continent, was first invented. These consisted of a number of barrels (small-arms) put together bundle fashion and firmly fastened together; the barrels were breech-loading and mounted on an axle carried on two wheels. A description of this gun is given by Leopold Frondsberg in his book on the art of war. The "bullet pump" was used as a field piece.

During the XVI. and XVII. Centuries guns of this description were in use in all the European armies. The progress of invention and the introduction of made-up cartridges for the powder charge led to further improvements in this type of armament. In 1678, Daniel Kollman, the

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Director of the Vienna Arsenal, designed a multiple-barrel gun; it consisted of 50 tubes arranged in two horizontal rows: the tubes were of rolled brass, each 27½ in. long, with an internal diameter of $\frac{9}{10}$ in. The so-called "Saxon organ-gun" (introduced in 1814) consisted of 64 barrels in eight horizontal rows which could all be discharged practically simultaneously. The so-called "Danish blunderbuss" had two rows of 20 barrels; it was still in use as late as 1864. These guns had an extreme range of 400 yards. The many disadvantages possessed by these early types of machine gun led to their premature suppression. At the beginning of the XIX. Century, an attempt was made to utilize the expansive force of steam as a propellant in place of gunpowder. In 1805, Watt experimented with a "steam-gun." The French general Girard designed a 6-barrel gun working with steam power, a boiler for generating the steam being carried on the gun-carriage. A large number of this latter type of gun was in existence in 1814, and it was proposed to employ them for the defence of Paris; 180 shots per minute could be fired from them. This type of gun was also discarded on account of its manifest disadvantages and the same fate befell the "Steinheil gun," invented in 1832, the projectiles from which were discharged by the rapid rotation of a wheel.

The American Civil War (1861-1865) led to considerable progress in technical matters connected with armaments. Among the ideas borrowed from the past was the principle of the "repeating rifle." The first of the weapons of this type was a multiple-barrel gun, consisting of 25 (small-arm) barrels in one row, and was used with success at the Siege of Charleston in 1863. It had a range of 1,200 yards (at 9° elevation) and was capable of discharging 175 projectiles per minute. Another machine gun used in the American Civil War was the Gatling. The Federal troops installed some of these in their lines on the James River in 1862, as well as on their boats on the Mississippi. In its perfected form, it consisted of four to six barrels of large calibre and ten of small calibre carefully bound together; the whole of these barrels moved on a single pivot.

The Gatling gun was a breech-loader, the cartridges being contained in a cylindrical attachment. One man was employed to load the chambers of this cylindrical attachment, whilst a second caused the barrels to rotate by turning a handle. As each barrel arrived in its lowermost position, it was fired automatically. The 10-barrel Gatling (calibre $\frac{4}{10}$ to $\frac{6}{10}$ in.) could fire 200 to 300 projectiles per minute; this gun weighed nearly 8 cwt.

In 1881, the Gardner gun, built on the same lines as the Gatling (calibre about $\frac{4}{10}$ in.), was introduced into the British Army.

After the experience of the Six Weeks War of 1866, when the Prussian needle gun proved so effective, France and the other European countries realized the absolute necessity of putting breech-loaders into the hands of their troops. Time was required to effect this change; after the Six Weeks War the tension between France and Prussia began to increase, Napoleon III. therefore felt that the storm might burst before the rearmament of his troops could be completed, and he consequently decided to introduce into his army a weapon capable of augmenting the rifle fire of his infantry. The weapon selected by him was constructed

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on lines similar to those of the Gatling; the cartridges were, however, contained in a box-like receptacle instead of a cylindrical one.

Experiments were made in France about this time with the *mitrailleuse*, on the Manceau system, consisting of 21 barrels arranged in three horizontal rows. Difficulty was experienced with the method of obturation then used, nevertheless the weapon was capable of discharging 126 to 168 rounds per minute; the weight of the piece was about 4 cwt. An improved model of *mitrailleuse*, system Montagny, was introduced into the French Army in 1867; it consisted of 25 barrels (calibre $\frac{1}{2}$ in.) placed either chequerwise or in horizontal rows of five each. This gun was capable of discharging 200 rounds per minute.

In 1870, further improvements were effected in the design of the *mitrailleuse* by Christophe and Montagny of Liège. This type consisted of 37 rifled barrels of steel (calibre $\frac{4}{10}$ to $\frac{56}{100}$ in.) which were surrounded by a wrought-iron jacket. The gun was so mounted that when in action the barrels could, by means of a screw, be given a slight horizontal movement, or mowing action, to right and left. Up to 2,000 yards range, its fire was very accurate; 410 to 480 rounds per minute could be discharged from it. This improved *mitrailleuse*, as well as those of the models Montagny and Manceau, were used by the French Army in the Franco-German War of 1870-1871. In all the types of multiple-barrel guns mentioned above the longitudinal axes of barrels were parallel to one another, so that the cone of dispersion of the bullets was exceedingly small, so much so was this the case that from 10 to 15 bullets had been found on the body of a single soldier killed on the field of battle. In order, if possible, to remedy this defect Werder, the inventor of the Bavarian rifle of that name, assembled the barrels so that their longitudinal axes diverged from one another from the breech-end towards the muzzle. A multiple-barrel gun of the Werder model was used by the Bavarian Artillery in the War of 1870-1871, but without much success.

Machine guns did not come up to expectation in the Franco-German War of 1870-1871: it was, however, recognized that they possessed very useful properties for defensive purposes, in consequence, weapons of this type continued to be used. About this time the Nordenfeldt, Hotchkiss and Gardner guns (sometimes referred to as *revolver guns*) appeared on the scene; the number of barrels was reduced in these to two or four, but the calibre was increased. The Hotchkiss was provided with five barrels (calibre about $1\frac{1}{2}$ in.).

The first machine guns of the designs last referred to were all too heavy to be employed as field pieces; Hiram Maxim first solved the problem which made it possible to construct mobile machine guns suitable for use with a field army. Maxim concentrated his attention principally on two points:—

1. A reduction in the number of the movements necessary to load and fire the gun and the replacement of human effort by automatic action for effecting these movements.

2. The utilization of the recoil on discharge as a useful force for opening and closing the breech and for feeding the ammunition into the breech.

Maxim's gun had a single barrel and was the first of the type to which the term *automatic* gun has been applied; his first patent was taken out

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in 1883: the 89 model was capable of firing 600 rounds per minute, a band feed being used. The total weight of this gun was only 270 lbs.

Since 1890, every European Power has introduced machine guns into its army and the number of these guns provided in each army has been steadily increasing. Each nation has adopted a special model of its own; the best known being the Schwarzlose, the Hotchkiss, and the Maxim.

Machine guns have played, and are playing, a most important *rôle* in the present war; they are the arm of the XX. Century.

INFORMATION.

Switzerland.—The description of the new field service uniform for the Swiss Army commenced in the number of the *Revue* for June is concluded (*vide* September *R.E. Journal*).

This number concludes with a bibliography.

No. 9.—September, 1915.

SOME OF THE PRINCIPAL HISTORIANS OF THE WATERLOO CAMPAIGN.

The events of 1915 have largely overshadowed those of 1815. The operations which took place in the memorable year last mentioned have, perhaps, been the cause of more controversy on the part of military writers than those connected with any other campaign in the world's history; the stirring acts connected with Napoleon's final struggle have proved, even at this date, not to be sufficiently remote to allow of an impartial expression of opinion in relation thereto. The conflicting claims set up for the armies of their own country severally by the historians of the nations taking part in the operations have, to some extent, kept the controversy alive.

As recently as December, 1903, a speech of the German Emperor on the occasion of the celebration of the Centenary of the Hanoverian Regiments which took part in the Waterloo Campaign added fuel to the dying embers. The following passage occurs in His Majesty's speech: "In casting a glance backwards on the past, let us render a just tribute to the German legion in memory of its incomparable deeds on the field of Waterloo, where with Blucher and the Prussians, *it saved the British Army from destruction.*" The *Journal des Débats* in its issue of the 24th December, 1903, commenting on the German Emperor's speech remarks: "This lesson should be taken to heart by us in relation to history considered as an exact science, as simple philosophy. Here is a battle, the most formidable one of the century, the one fraught with the most far-reaching consequences. German science teaches that without Blucher the Allies would have lost. An English proverb runs: 'That's to arrive after the battle, as Blucher did after Waterloo,' whence it follows that in England the *rôle* played by this general is considered similar to that of the Carbineers of Offenbach. Some pundits, in Belgium, claim that the battle was won by the Belgians. It is held, in France, that had Grouchy risen from the table before dessert, the whole face of the world would have been changed."

The *Times* and the *Globe* took up the cudgels on behalf of Great Britain, and pointed out that the German Emperor had not made a happy choice of words in referring to the part played by Blucher, the latter paper remarking that to render a signal service to anyone is by no means the same thing as to save him from destruction. The German

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Press made a reply reiterating the claim that the British would have been defeated at Waterloo had it not been for the timely arrival of the Prussians and, at the same time, expressed regret that the British were so touchy on the subject of Waterloo.

The conflict of opinions in relation to the part played by the Allied troops has existed from the earliest days; the origin of this conflict can probably be traced to Wellington's dispatch of 19th June, 1815, to Lord Bathurst in which he states that he must do justice to Blucher and the Prussians and gives them credit for the fortunate results which followed on account of their intervention in the battle. The Iron Duke in express terms states that the march of Bulow on the enemy's flank was decisive; he adds that *if he had not himself been in a position to deliver the attack which decided the affair*, the Prussian general would have compelled the French to retire.

Gneisenau, Blucher's Chief of the General Staff, who wrote his report of the battle at the same time as Wellington compiled the dispatch, referred to above, naturally looked at the situation from a different angle of view. He refers to the stand made at the plateau of Mont-Saint-Jean, and adds: "But the superiority in numbers of the enemy was too great: Napoleon was continually pushing forward enormous masses, and however stubbornly the British troops might have been prepared to fight, in order to hold on to their positions, it was impossible for their heroic efforts to last for ever. It was 4.30 . . . not a moment was there to be lost. The generals (Prussians) did not let them slip away. . . ." Gneisenau expresses the opinion that the fate of the French Army was settled by a charge delivered by Ziethen's cavalry against its right flank.

The accounts of German writers have agreed substantially with those of Gneisenau stated above, but there has not been the same unanimity on the part of British writers. The most sober of the British authors of the first half of the XIX. Century, of whom Siborne is one of the best known, and the majority of those of the second half of the century have claimed the victory at Waterloo as being exclusively won by the British troops, and have declared that the Prussians played an insignificant *rôle*. Ronland Blennerhasset, writing in *The Nineteenth Century* in 1904, goes so far as to claim that the steadiness of the British infantry saved the Prussian Army from annihilation. In a work containing the recollections of Serjt. Wm. Laurence, published about ten years ago, it is interesting to note that in writing of Blucher's troops the serjeant states that these reinforcements arrived after sundown and only just in time to pursue the retreating enemy.

As is well known Chesney, whilst a professor at the Staff College, expressed the opinion that the popular views held in Great Britain on the subject of the Battle of Waterloo were as near the truth as those contained in the famous chapter of Victor Hugo's *Les Misérables*. Sir Herbert Maxwell has also drawn attention to the fact that 90 per cent. of British people look on Waterloo as a purely British victory, in which the Prussians, if anything, played a very secondary part. A century after the great battle, the opinions of the British public on this subject remain practically unchanged.

Many works have been published on this campaign in Holland and

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in Belgium. As recently as 1908, three large volumes on the Waterloo Campaign, based on documentary evidence, were completed by Colonels de Bas and T'Serclaes, the Chiefs of the General Staff of the Dutch and of the Belgian Army respectively They claim a share in the military glory accruing to the Allies in respect of this campaign on behalf of the armies in which their ancestors fought.

In France, the subject has been discussed from a totally different angle of view. The aspect of the situation dealt with in that country is no longer one concerning national dignity; rather is it one affecting the fundamental principles of war as applied by one of the greatest captains the world has known. The important question is: did Napoleon owe his defeat to his own mistakes? The majority of Frenchmen have never been willing to admit that such was the cause of the great Corsican's misfortune. In France, the view prevails that some misadventure or treason alone can have been responsible for his failure. The French report of the battle attributes the rout of Napoleon's army to a sudden panic which overtook it. General Drouot adopted this view when addressing the French Chamber on the 23rd June, 1815.

No advocate has pleaded his cause more brilliantly, none has shown himself more adept in the art of persuasion, none has exhibited more eloquence than has the defeated Emperor when dealing with the catastrophe of the Hundred Days. To read his *Dictées de Saint Hélène*, even now after the elapse of a century since his views were committed to paper, is to smell fresh-burnt gunpowder.

As is well known during his captivity at Longwood, Napoleon procured from Europe practically every work published in relation to his last campaign; he frequently made biting comments on their contents in the margins thereof. In the work entitled *Mémoires pour servir à l'histoire de la vie privée du retour et du règne de Napoléon en* 1815, Fleury de Chaboulon wrote, in reference to the Emperor's return to Paris: "The reasons which prompted Napoleon to separate himself from his army at Laon are not known. I will throw light on the subject." Napoleon has entered in the margin of his copy the following remark: "Very bad and just what one would expect from a young man who has to treat of a matter of this kind for the first time."

In the *Commentaries sur l'Art de la Guerre*, published in 1818, the author criticises, in no measured language, the dispositions made by the Emperor at Waterloo. The Great Captain adds a note in the margin: "History proves that all libels are promptly forgotten. Let libellers rummage amongst the files affecting Henri IV. and Louis XIV. stored in the National Library; they will be humiliated by their impotency; no trace remains of any defamatory matter."

Napoleon's first account of the Waterloo Campaign was published in 1818, ostensibly as the work of General Gourgaud. In the preface to this work it is declared: "All the chances of victory were in favour of the French. The moves were all well co-ordinated, great prevision was shown; but what can even the highest form of genius hope for when an adverse fate intervenes?"

In the same year Berton published his *Précis historique, militaire et critique des Batailles de Fleurus et de Waterloo;* in it the author attributes the Emperor's misfortunes to three great mistakes. The first of

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these was the recall of d'Erlon's Corps, on the 16th June, by Ney when it was marching on Ligny by Napoleon's orders. The second was the timidity and slowness shown by Grouchy, on the 17th June, in pursuing the defeated Prussians after the fight at Ligny. The third was the delay and uncertainty in the movements of Grouchy, on the 18th June, on the French right.

In 1820, Gourgaud published his *Mémoires pour servir à l'histoire de France sous Napoléon*, this work has also been annotated by the Emperor. The latter puts the blame for the disaster which overtook him definitely on three men: Murat, King of Naples, on account of his unfortunate move against the Austrians which, in his opinion, precipitated the war; Ney, for allowing Wellington to establish the British position at Quatre Bras; Grouchy, for his failure to render Blucher innocuous. Some of the works published in relation to the Hundred Days have been inspired by political *hatred* rather than a desire to search out the truth; in this class stands the work entitled *Relation fidèle et détaillée de la dernière campagne de Bonaparte*, published in 1816; according to its author the infamous conduct and incapacity of Bonaparte were, without any doubt whatsoever, the sole cause of France's ruin.

One of the most interesting documents connected with this epoch is Ney's letter addressed, eight days after the battle, to the Duke of Otranto, President of the Provisional Government; in it he protests with vehemence against the accusations of treason levelled against him. The bitterness shown in this letter is not incited alone by defeat.

Three years after the first publication of Gourgaud's work Gamot, Ney's brother-in-law, published his *Réfutation* in which the orders issued by Napoleon were reproduced. But the appearance of the *Mémoires de Sainte-Hélène* by Las Cases in 1820, followed two years later by his *Mémorial de Sainte-Hélène*, silenced the Emperor's enemies.

A very critical examination of the Waterloo Campaign was made by Jomini in his *Traité des grandes opérations militaires*. In a copy of this volume, which Napoleon had at St. Helena, he entered a note expressing the opinion that the work was one of the most valuable criticisms on the campaign published up to that date. Jomini had also intended to make the subject matter of the 1815 Campaign the 22nd Chapter of his *Vie politique et militaire de Napoléon, racontée par lui-même au tribunal de César, d'Alexandre et de Frédéric*; however, the manuscript prepared was mislaid and not discovered again till 1839 (12 years after it was penned). Without disputing the point that Ney, Grouchy and other subordinate generals committed mistakes, Jomini deals with those for which, in his opinion, the Emperor should be personally held responsible. He refers to the fact, patent to all students of war, that Napoleon did not act with his customary energy in this fateful June. Speaking of the 16th June (the day before Ligny), he writes: "One is compelled to admit, that his conduct on this morning will always remain a mystery for those who knew him best." He makes a similar remark in relation to the Emperor's acts of the day following.

At the time that Jomini was writing in France Clausewitz was studying the 1815 Campaign in Germany. These two writers are in agreement on many points in relation to the Waterloo Campaign, but there are points on which their views are in direct conflict; these two students

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of war differed widely in their mental attitude. The empirical methods of Jomini did not suit the philosophical mind of Clausewitz; further the latter never really grasped the fundamental principles of the Napoleonic strategy; sympathetic to Blucher, indifferent to Wellington, he was distinctly hard on Bonaparte.

Clausewitz's views were little known in France till 1900, in that year was first published a French translation of his great work, but his philosophical reasoning did not appeal to the French imagination. Two French writers, Lieut.-Colonel Charras and the historian Edgar Quinet, have given expression to opinions very similar to those propounded by Clausewitz.

The first three editions of a work entitled *Histoire de la campagne de* 1815 attracted considerable attention in foreign countries as soon as they were published. However this work was not read in France; in it, the author Charras violently attacks both Las Cases' *Mémorial* as well as his *Mémoires;* he makes a critical examination into the conduct of the principal actors, with the aid of numerous unpublished documents, and comes to the conclusion that alone is it due to misplaced sentiment, to convictions illogically arrived at, that the quality of infallibility has been almost universally attributed to Napoleon. Charras's opinions have not been acceptable in France, and Quinet who, in some measure echoed the views of Charras, has been no more successful in gaining the ear of his countrymen; both these writers have acquired the reputation of being partial. The French, on the other hand, have readily accepted the views put forward by Thiers in his *Histoire du Consulat et de l'Empire;* in this work there was raised a new monument to Napoleonic infallibility.

During the past few years, the subject of the campaign has been again taken up. In 1899, Henri Houssaye published his *Waterloo*, which in a few months ran into its 15th edition. In this volume Houssaye, it is claimed, has said the last word on the subject. It is not possible, it is said, for any author to produce ampler documentary evidence, to present the same in a more logical sequence, to set out his arguments with greater precision, clearness and penetration, to arrive at better balanced conclusions. As of yore, Napoleon's lieutenants are again found guilty of the crime of having committed egregious blunders, the Great Captain is once more absolved of blame. He is neither the incapable leader some would have believe, nor the sluggard which others tell of, nor the ambitious egoist, nor the invalid suffering from premature senile decay.

In 1904, there appeared a work entitled *Critique de la Campagne de* 1815, in which its author, Lieut.-Colonel Grouard, challenged the conclusions arrived at by Houssaye. Grouard does not contest the sources of information relied on by Houssaye, although he draws attention to the insufficiency of some of the documentary evidence and inaccuracy in the reproduction of others. However, the Colonel, comparing the evidence once again and examining the same in a new light, draws therefrom, so far as the essential points are concerned and specially those affecting d'Erlon and Grouchy, conclusions the direct opposite to those drawn by Houssaye.

Since Grouard published his work, a considerable volume of new literature on the subject of the campaign has been produced in Germany and Italy. One of these works is a fantastic story in six volumes by the

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Italian historian Rustelli entitled *The Enigma of Ligny and of Waterloo.* The two best histories last referred to are those written by General Lettow-Vorbeck of the German Army and by General Albert Pollio of the Italian Army and are comparable to Houssaye's *Waterloo.* Lettow-Vorbeck holds views in conflict with those of Clausewitz and those made public by his compatriot York von Wartenbourg in a work entitled *Napoleon, Commander-in-Chief.* Lettow-Vorbeck is of opinion that the great stroke attempted by Napoleon to win victory for the French Eagle was "one worthy of the great past of the Emperor."

The work of General Pollio differs in some respects from the earlier writings on the campaign; fatalism occupies, according to him, a very prominent position in deciding the course of the events discussed. In future probably the Waterloo Campaign will possess only an archæological interest, and in the years to come it may be the numerous problems connected with the present War which will be of most absorbing interest.

MILITARY BANDS.

The recent mobilization of the Swiss Army has brought to light defects in the organization of the regimental bands; the organization is said to be bad and out of date, and no longer meets the exigencies either of the service or of good music. The problem of reorganizing the bands is a difficult one to solve; to find a practical and logical solution, it is necessary to bring the goodwill of the civil population and the special knowledge of the military authorities to bear jointly on the matter.

One of the main difficulties lies in obtaining good instrumentalists for the military service. It is possible that if the question is dealt with judiciously considerable improvements might be effected, but it is essential to abandon the idea that bands in the Swiss Army can ever be comparable to those in the German, French and Austrian Armies.

In Switzerland the bands belong to battalions as opposed to the German system of *regimental* bands; it is suggested that the number of bandsmen in each battalion should be doubled in order to obviate the necessity of employing civilian musicians periodically, as at present.

Full responsibility for the band should, it is urged, be vested in the bandmaster. It is admitted that duties connected with the maintenance of discipline and the interior economy of the band may interfere with the bandmaster's primary duty of giving the bandsmen instruction in connection with the technique of music.

Some modifications are necessary in the methods adopted in selecting battalion bandmasters; if possible they should be selected from the ranks of accomplished professional men in the civilian ranks; and they should be given rank in the army, not lower than that of sergeant. The three battalion bandmasters should act under the orders of a regimental bandmaster, who should be of officer's rank and should be made responsible for the instruction in music of the three battalion bands of the regiment.

The question of the repertory of a military band requires to be most carefully overhauled; time alone can cure the deep-rooted defects existing in this matter at the present time. Greater care also is necessary in connection with the method of procuring musical instruments; it is desirable that all instruments with a particular band should be manufactured at the same factory, thus only can be obtained that quality of *timbre* essential to perfect harmony.

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It is suggested that the Swiss *Société fédérale des fanfares*, which has exercised a beneficial influence on civil bands, should devote its attention, with a similar object, to military bands. A logical reorganization of the Swiss military bands can only be of permanent value if carried out after careful investigation of the minutest details, without any scruples regarding vested interests and with the earnest desire of putting military bands in a position efficiently to perform the duties which naturally appertain to them.

Notes and News.

Switzerland.—Reference is made to the fact that a separation was effected, in August last, between the political censorship and the military censorship in Switzerland. It is remarked that the tone of the Swiss Press has, in consequence, improved and it is regretted that so simple a measure, one which would have obviated many misunderstandings in Switzerland, was not adopted earlier. Satisfaction is expressed with the methods adopted by the political censorship; it is further stated that the separation of the two branches of censorship has eased the situation in the military office which gave rise to so much friction in the past. Switzerland being a small country it is more difficult to keep from the knowledge of the public information concerning incidents which have taken place in the Republic; for this reason it is desirable that the Press should refer to them rather than that the public should begin an ill-informed discussion on the subject. In Germany, it is the Government which moulds public opinion, this is not so in Switzerland, where public opinion has its birth outside Government circles and cannot be ignored; further, in the latter country it is, at all times, a most delicate instrument which cannot be governed by rules and regulations prepared by a General Staff, more tact being required to control it than that necessary to command an army. The proper criterion by which the censor should be guided in deciding whether in any particular case he should exercise his power of excision should depend on the answer to the question: Is the publication of this information at all likely to compromise national defence? If the answer to this question is in the affirmative, clearly the censor cannot do otherwise than erase the words which jeopardize the success of the military measures adopted; if in the negative, the widest latitude should be allowed the Press in relation thereto.

The differences of opinion between the two main branches—the German and the French—of the Swiss public are not great; the admirers of the political anachronism represented in liberal Europe by the absolute rule of a military autocracy so closely associated with the dominion of the Hohenzollerns in Germany are few indeed. Much of the suspicion and misunderstandings which have prevailed in the Republic have had their origin in the attitude of the minority on this subject.

A rumour has been afloat in Switzerland that one of the belligerents has succeeded in tapping one of the military telephone lines in the Republic. Such an act it is pointed out cannot but have been deliberate and amounts to a calculated violation of Swiss neutrality. It is urged that the true facts relating to the incident which gave rise to this rumour should be officially disclosed.

A painful surprise has been caused in Switzerland by the prohibition of the sale and distribution of the German text of the Belgian Red Book

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entitled *Berichte über die Verletzung des Völkerrechts in Belgien* (Report on the Violation of International Law in Belgium).

The Federal Council appears also to have raised a storm of indignation by seizing one of the numbers of the *Bibliothéque Universelle* of Lausanne. It is stated that the management of this publication has caused counsel to be instructed to raise, in the Federal Courts, the question of the legality or otherwise of the act of the Federal Council; and it is hinted that there are men enough in the Republic who will see to it that the provisions of the Constitution are strictly observed by the Government, even under the exceptional circumstances which now prevail. It is demanded that the decisions of the censors shall not be arrived at in the inner recesses of some dark dungeon. It is stated that experience has abundantly proved that even the most intelligent individuals find it impossible to carry on a government efficiently in the absence of a counter-weight in the form of public criticism. Imperialist Germany, in the hands of a government subject to no checks, will yet prove the ruin of Europe and of her own misfortunes. The cry is raised: Let us be done with plenary powers; they prevent us from being Swiss.

Portugal.—A contribution from a special correspondent is published in which reference is made to the fighting which took place between Portuguese troops and Germans in Angola when the latter took some Portuguese soldiers prisoners. These prisoners were incarcerated in Damaraland, until the successful enterprise under General Botha placed German S.W. Africa under British dominion; the Portuguese prisoners have now returned safely to Lisbon.

Steps have been taken to develop the national aviation service in Portugal; a publicity campaign has been started and it is proposed to carry out competitions and to do all things else to popularize aeronautics. An aviation ground has been established about 25 miles from Lisbon.

The 1st and 5th Divisions and detachments of minor importance were detailed for the autumn manœuvres of the current year.

CORRESPONDENCE.

A short note by a Swiss officer is published dealing with the article entitled "*Independence and Neutrality. Le devoir suisse*" (reviewed in *R.E. Journal* for September, 1915, and in current number). The writer of the Note states that he has made a careful search of the documents relating to the French Army of occupation stationed in Switzerland in 1798 and has been unable to find any record of the alleged cruelties attributed to the XIV. French Demi-Brigade; the charges of cruelty occur alone in works by German Swiss historians. The unfortunate people of the Quatre-Cantons Lake region assuredly had much to suffer during the War of 1798—1799; but, all the same, the national historians have unnecessarily exaggerated their trials. The author of the article on "*Independence and Neutrality*" is also taken to task for the silence maintained by him on the subject of the premeditated destruction (by fire) by the Germans of Louvain, Dinant, Aerschot and Senlis, acts which were far more execrable, in the opinion of the writer of the Note, when committed in the year of grace 1914, than was the burning of Brunnen in 1798.

This number concludes with a bibliography of literature of military interest.

W. A. J. O'MEARA.

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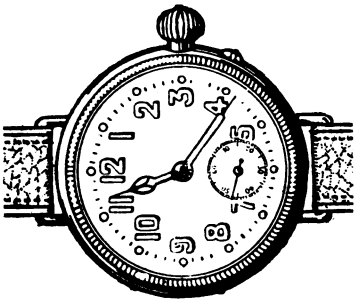

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